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WOOLEY (J. C.). **The durability of fence posts.**—*Missouri Agric. Exper. Stat. Bull.* 312, 8 pp., 4 figs., 1932.

The following increases in the serviceable life of fence posts have been obtained by various fungicidal treatments carried out by the Forestry Department of Missouri University since 1913: setting in gravel, 0·63 years; charring the butt ends, 0·33; Avenarius carbolineum [*R.A.M.*, vi, p. 364], 2·4; creosote (two brush coats), 0·3; creosote (two-hour open tank), 5·7; and creosote (five-hour double tank), 7·6. Among the timber varieties responding satisfactorily to the last-named process are white cedar [*Chamaecyparis thyoides*], white oak [*Quercus alba*], red oak [*Q. rubra*], and black ash [*Fraxinus nigra*], and treatment is economically justifiable unless the initial cost of the wood is unusually low. In a test with zinc chloride (5 per cent.) and sodium fluoride (3 per cent.) started in 1927 there are two failures out of 50 posts to date with the former and 21 with the latter.

IKATA (S.) et al. **On the mode of penetration of a Peronospora species into a host.**—*Journ. Plant Protect.*, xvii, 6 pp., 5 figs., 1930. (Japanese.) [Abs. in *Japanese Journ. of Botany*, vi, 2, pp. (34)–(35), 1932.]

In hanging drop cultures of *Peronospora brassicae* [*P. parasitica*: *R.A.M.*, xi, p. 220], parasitic on *Brassica pekinensis* in Japan, the conidia produce germ-tubes which in turn give rise to vesicles (appressoria), measuring 13 to 25·6 by 10 to 16 $\mu$, at the apex and elsewhere. Inoculated on a leaf surface, each conidium produces a germ-tube, from which a vesicle develops over a stoma and in turn emits a long hypha which enters the leaf tissues through the stoma. Cuticular infection was not observed.

HARTER (L. L.) & ZAUMEYER (W. J.). **Bean diseases and their control.**—*U.S. Dept. of Agric. Farmers' Bull.* 1692, 27 pp., 15 figs., 1932.

Popular notes are given on the symptoms, causes, and control of the more important bean [*Phaseolus vulgaris*] diseases in the United States, including anthracnose (*Colletotrichum lindemuthianum*), bacterial blight (*Bacterium phaseoli* and *Bact. medicaginis* var. *phaseolicola*), mosaic [*R.A.M.*, xi, p. 417], rust (*Uromyces appendiculatus*), curly top [ibid., xi, p. 219], powdery

mildew (*Erysiphe polygoni*), ashy stem blight (*Macrophoma* [*Macrophomina*] *phaseoli*) [ibid., ix, p. 82], and angular leaf spot (*Isariopsis griseola*) [ibid., x, p. 83]. Lima beans (*P. lunatus*) also suffer from infection by *M. phaseoli*, as well as from downy mildew (*Phytophthora phaseoli*) [ibid., ix, pp. 136, 289], pod blight (*Diaporthe phaseolorum*) [ibid., iv, p. 136], bacterial spot (*Bact. vignae*) [ibid., x, p. 537], and yeast spot (*Nematospora phaseoli*) [*N. coryli*: ibid., v, p. 390; xi, p. 638].

BRANDENBURG (E.). **Die Herz- und Trockenfäule der Rüben—Ursache und Bekämpfung.**—[The heart and dry rot of Beets—cause and control.]—*Angew. Bot.*, xiv, 3, pp. 194–228, 8 figs., 1932.

Continuing his studies at Bergen op Zoom, Holland, on the cause and control of heart and dry rot of beets [*R.A.M.*, xi, p. 147], the writer conducted a series of laboratory tests with water, sand, and sand-peat cultures, supplemented by an extensive field experiment, on the effect of boric acid and borax on the disease.

One of the three series of six sugar beet plants each in the water cultures (containing 1 mg. manganese sulphate per l.) received no boron, while the other two were given 0·7 mg. boric acid per l. The nutrient solution was that used by Zinzadze (*Landw. Versuchstat.*, cv, p. 267, 1929). As in the case of previous tests with fodder beets, the plants receiving boric acid developed well, while the others began to wilt and decay in about three weeks and ultimately died. When the boric acid supply was withheld after some weeks from one series, the typical symptoms of heart and dry rot developed, though not until the end of four to five weeks. The dry rot symptoms on the sides of the roots and discolorations of the tissue between the rings of the vascular bundles were much more marked than in fodder beets. The plants receiving a regular supply of boric acid remained completely healthy.

In the tests with sand and peat cultures the plants were grown in pure quartz sand or in sand and peat mixtures in 10 l. vessels with an inorganic nutrient medium. Boric acid at the rate of 1, 2, 5, 10, and 30 mg. was added to one lot, the two latter concentrations maintaining the plants in the mixtures of sand and peat entirely healthy, while those receiving the smaller doses gradually succumbed to the disease. In the lot in sand the plants remained healthy for ten weeks even without the addition of boron, indicating that traces of this substance were present as impurities; eventually all developed the typical symptoms, which were very slight, however, after 18 weeks in the beets receiving 30 mg. The plants in the sand and peat mixtures without boron began to wilt after four weeks. Evidently the peat binds the traces of boron in the sand in such a way as to render them unavailable for the plants. The increased yield (by weight) in the sand-peat cultures with 30 mg. boric acid amounted to 394 per cent. over that of the controls, the sugar content being 16·3 per cent. compared with 15·4 per cent. for the sand cultures with 30 mg. boric acid and 8·8 and 6·6 per cent., respectively, for those in sand-peat and sand without boron. A further test showed that the percentage increase in the

weight and sugar content of the beets in sand-peat cultures receiving 5 mg. boric acid was approximately equal with a strongly acid ($P_H$ 5) and a nearly neutral (6·8) reaction of the medium. Symptoms of heart and dry rot were just as apparent at $P_H$ 5 as at 6·8, indicating that alkalinity is not the primary cause of the disease.

Minute protuberances, turning from pale green to brownish-black, covered the inner side of the youngest petioles in plants suffering from a chronic form of heart rot. The roots of plants in sand without boron were almost entirely rotted.

Experiments were carried out to determine the effect of boric acid on sugar beets grown in the vessels in soil from a Silesian estate on which the disease was so severe as to cause frequent crop failures. The addition of 10 mg. boric acid per vessel increased the weight of the plants from 158·5 to 236·5 gm. and the sugar content from 17·2 to 18·18 per cent., the corresponding figures for 50 mg. being 240·7 gm. and 18·5 per cent. Field tests were conducted on the same estate, two out of six 3-are plots being given boron in the form of boric acid (2, 3, 5, 10, and 20 kg. per hect.) and four in that of borax, 1 part of the former being reckoned as equivalent to 1·5 of the latter. The substances were mixed with sand and strewn over the ground ten days after the sowing of the beets on 15th May, the field having previously been heavily fertilized. On the untreated plots the plants developed severe heart and dry rot, which had affected over 50 per cent. of the crop by 24th September. In places the foliage was completely withered, and even the healthy beets remained comparatively small. On the other hand, the plants treated with boric acid or borax, especially at the higher concentrations, developed vigorous healthy foliage and the incidence of disease was reduced from 59 to 2, 0·7, and 0·2 per cent., respectively, in the lots receiving 5, 10, and 20 kg. per hect., the figures for those to which 2 and 3 kg. were applied being 12 and 4 per cent., respectively. The highest yield was obtained from the plots receiving 3 kg. boric acid or 4·5 kg. borax per hect.—an increase of 34·8 per cent. over the untreated. The sugar content of the treated beets was increased by approximately 2 per cent. at all concentrations. In addition to these tests, three plots of 1·5 hect. each were given 9, 20, and 30 kg., respectively, of borax while two strips of 1 hect. each traversing the entire field were left untreated. Here again the treated plants remained practically free from heart and dry rot, which occurred in a fairly severe form over the areas receiving no borax. By the end of September the average incidence of the disease in all the treated plots was only about 4 per cent.

Analyses showed that the boric acid content of the ash of healthy beets was 0·360 to 0·442 per cent. compared with only 0·105 to 0·287 per cent. in diseased ones. The ash content of severely diseased beets was much higher than that of the healthy (6·01 per cent., compared with 1·91 and 2·26 per cent. in the plots receiving 20 and 30 kg. borax, respectively).

Tomato and potato plants grown in a nutrient solution to which boric acid (0·5 mg. per l.) was first applied and then withheld developed various abnormalities of growth and discoloration of the

vascular bundles of the stalks and petioles, which were absent from those receiving a regular supply of boric acid. Similar results were obtained by E. S. Johnston (*Soil Sci.*, xxvi, p. 173, 1928), also in collaboration with P. L. Fisher (*Plant Physiol.*, v, p. 387, 1930).

The application of the data yielded by the beet experiments to practical cultivation is discussed. Probably the best results would generally be given by an early application of boron, at the time of sowing or a little later, with one or more repetitions during the summer. Further investigations are necessary to determine the requisite amounts to be given under varying soil and climatic conditions.

Du Plessis (S. J.). **White mould in Onions.**—*Farming in South Africa*, vii, 75, pp. 112–114, 2 figs., 1932.

A popular account is given of the white mould of onions which has long been known in South Africa, though its causation by *Sclerotium cepivorum* [*R.A.M.*, xi, p. 219] has only recently been established there. The disease has so far been reported only from Stellenbosch, Caledon, Wolseley, and Villiersdorp.

White mould is favoured by low temperatures (10° to 20° C.) and a medium moisture content. The sclerotia may persist in the soil and in onion refuse for a number of years (four or more), so that prolonged crop rotation is essential for the control of the disease. The sclerotia succumbed to immersion in 0·1 per cent. mercuric chloride for 15 to 20 minutes, and also to 45 minutes' heating at 100°, but these measures, as well as disinfection of the soil by formalin, are impracticable on a large scale. Brief indications are given of cultural methods likely to bring about a reduction in the incidence of infection.

Lauritzen (J. I.). **Development of certain storage and transit diseases of Carrot.**—*Journ. Agric. Res.*, xliv, 12, pp. 861–912, 1 graph, 1932.

This is a detailed and fully documented account of the author's investigation under controlled conditions of the influence of external factors, chiefly temperature and air humidity, on the incidence and development of storage and transit rots of carrots in the United States, caused by *Sclerotinia sclerotiorum*, *Rhizopus tritici* and *R. nigricans* (the only two species of this genus which appear to occur on carrots under normal Washington conditions) [cf. *R.A.M.*, iii, p. 546], *Botrytis cinerea*, and *Bacillus carotovorus*. The results indicated that the safest environmental conditions for the storage of carrots are a temperature of 0° C. and a relative humidity of 90 to 95 per cent.

In tests designed to ascertain the varietal resistance of carrots to the various rots, 14 varieties were found to be susceptible to infection with *S. sclerotiorum*, 16 with *R. tritici*, 17 with *B. carotovorus*, and 18 varieties with *Botrytis cinerea*, and no significant differences were found in their relative resistance. At temperatures ranging from 0° to 15·5° C. most of the varieties were also susceptible to rotting by *Fusarium* and *Penicillium* spp.

Doran (W. L.). **Downy mildew of Cucumbers.**—*Massachusetts Agric. Exper. Stat. Bull.* 283, 22 pp., 1932.

A full account is given of the writer's studies on downy mildew of cucumbers (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*) in Massachusetts, where the disease is stated to be common and severe on all field and greenhouse varieties. The organism from cucumber was shown to infect muskmelon, but not squashes, pumpkin, or watermelon. Cucumbers are in no danger of infection from weed hosts in the State. The youngest leaves were found to be resistant.

No overwintering stages of the fungus have been found, and the inoculation of plants with material overwintered in the soil did not produce infection. All available evidence suggests that downy mildew reaches Massachusetts from southern States through the gradual northward movement of spores borne by the wind [*R.A.M.*, xi, p. 496].

Conidial germination took place at a temperature range of 9° to 30° C., with an optimum at 16° to 19°. Two to three hours on a wet leaf is sufficient for germination, and zoospores may be emitted and cause infection within five hours. The conidia remained viable for 50 hours in moist air. Infection usually results in sporulation within six to nine days, dew providing enough moisture for the process. Sulphur was more effective than copper-lime dust in preventing sporulation [ibid., xi, p. 421], the conidia being killed by contact with dry sulphur for five hours at 22°. Sulphur was not toxic, however, to the conidia in water, and infection was not prevented when the latter fell on dusted leaves. Sulphur not only failed to give protection in the field but was definitely injurious to the plants. Both in the field and greenhouse copper fungicides are therefore preferable, Bordeaux mixture 3–3–50 being recommended for the former and 1–1–50 for the latter.

Hayes (T. R.). **Groundnut rosette disease in the Gambia.**—*Trop. Agriculture,* ix, 7, pp. 211–217, 4 figs., 1932.

In noting the increasing economic importance of groundnut rosette disease in the Gambia [*R.A.M.*, xi, p. 697], the author describes at some length three types of the trouble observed by him, all of which have been shown to be transmissible by grafting, though proof has not yet been obtained that any particular insect can carry them in the Gambia. The first type, termed 'chlorotic rosette', is by far the most common; it usually shows up first at the tip of a lateral shoot, the young leaves of which are flaccid and soon develop small light yellow patches, which in time become green but of a slightly paler shade than normal. The next pair of leaves usually exhibit light yellow and pale green spots which do not turn greener, while the remainder of the leaves assume a darker green than normal. The affected leaves are narrower and more pointed than the healthy, and those that develop about two weeks after infection are much smaller than usual, and crinkled. As the disease develops the petioles on the affected parts become progressively shorter, until finally the leaves are almost sessile; a similar shortening also occurs in the internodes. The flowers of diseased plants are reduced in size, sessile, and fail to open.

The second (green rosette) type usually occurs in small groups only, and is rather infrequent; it differs from the first in that it is not accompanied by chlorosis, the whole of the diseased leaves being of a darker green than normal; the leaves are shorter but not narrower than usual, giving them a roundish appearance; and in contrast to plants affected with chlorotic rosette, green rosetted plants do not flower more profusely than normal. Grafting experiments appeared to indicate that these two types are caused by two distinct virus entities. In the third type (rosette type 3) the leaves are normal in colour, but much smaller and thicker; the stems are also considerably thickened, and the branches curve in a clockwise direction. Only two plants of this type were observed, but it is pointed out that the lack of distinction in the colouring of the healthy and diseased leaves renders the trouble easy to overlook.

Observations of the behaviour of the rosette disease in native fields, supported by preliminary experiments, have shown that late groundnut plantings are more susceptible to it than early sowings; wide spacing of the plants gives more disease than close planting; plants growing on the border of the plots are more liable to be infected than those in the middle; and a cover of weeds (particularly of the grass *Digitaria marginata*) tends to reduce the incidence of the disease, presumably by protecting the soil from evaporation, since there was evidence that in the Gambia the disease is associated with periods of drought. In the author's opinion these observations supply a possible line of attack on the trouble, by correspondingly altering the agricultural practices now in force among the natives.

Du Plessis (S. J.). **Anthracnose of the Vine.**—*Farming in South Africa*, vii, 75, p. 104, 1932.

Among the vine varieties observed to be highly susceptible to anthracnose (*Gloeosporium ampelophagum*) in South Africa are Appley Towers, Carignan, Muscadel, Ohanez, Sultana, and Waltham Cross, while Ferdinand de Lesseps, Golden Queen, and Shavoah are extremely resistant. Very resistant varieties further include Black Hamburg, Formosa, Hermitage, and Raisin Blanc, while a number of others [which are listed] are intermediate in their reaction.

The control of the disease should be based on thorough sanitation, supplemented by a dormant treatment of the vines with 1 in 8 lime-sulphur or 4 per cent. sulphuric acid, and three or more applications of Bordeaux mixture 4–4–50, (*a*) when the young shoots are 6 to 10 in. long; (*b*) when the flowers drop; and (*c*) at fortnightly intervals under humid conditions.

**Report on the work of the North of Scotland College of Agriculture for the year 1930–31.**—30 pp., Aberdeen Journals, Ltd., 1931.

The following items of phytopathological interest occur in this report. W. M. Findlay states that, in addition to the Bruce turnip [*R.A.M.*, x, p. 637; xi, p. 759], a Swedish variety called Wilhelmburger and a strain of the Danish Bangholm proved relatively

resistant to finger-and-toe [*Plasmodiophora brassicae*: ibid., ii, p. 151; x, pp. 283, 574]. A selection from the Bruce, known as the Wallace, appears to be equally resistant with the parent variety.

According to D. Clouston the 'Lanarkshire' strawberry disease [or 'red core' (*Phytophthora* (?) *cinnamomi*): ibid., ix, p. 795], which has reduced the area of profitable cultivation in the Clyde Valley from 1,500 to 500 acres, has now appeared in the Aberdeen district.

**Report of the Agricultural Faculty for the year 1930–31.**—University College, Dublin, 14 pp., 1932.

In the section of this report dealing with plant pathology it is stated that the work on the production of virus-free stocks of potato varieties [at the Glasnevin Station] has been successfully prosecuted during the year under review.

Unfavourable weather conditions reduced the prevalence of dry rot [*Phoma lingam*: *R.A.M.*, ix, p. 218] of swedes. Accumulating evidence tends to implicate the remains of the old crop in the fields as the more usual source of infection. Although the seed is sometimes also responsible [cf. ibid., xi, p. 345], a very thorough examination of a number of commercial samples showed that many, if not most of them, were practically or completely free from infection. The possibility of cruciferous weeds being a contributory source of infection is being studied.

For the purpose of the further study of the overwintering and transmission of stem rust of oats [*Puccinia graminis avenae*: ibid., xi, p. 362], a large collection of species of *Berberis* was established; while a number of species and hybrids were found to be susceptible to the rust, the balance of evidence indicated that none of these is likely to be of practical importance except the highly susceptible common barberry, from which the rust spread to a slight extent to plots at Glasnevin of pedigree stocks of oats growing about a mile westward of the barberry garden. This is stated to be the first record of the rust in that locality.

MARCHAL (E.). **Recherches et observations effectuées à la Station de Phytopathologie de l'État pendant la période 1927–1931.** [Researches and observations carried out at the State Phytopathological Station during the period 1927–1931.]—*Bull. Inst. Agron. et des Stat. de Recherches de Gembloux*, i, 3, pp. 164–174, 1932. [Flemish, German, and English summaries.]

This report, which is on the same lines as that previously issued [*R.A.M.*, viii, p. 704], contains among others the following items of phytopathological interest.

Black chaff (*Bacterium translucens* var. *undulosum*), first recorded on wheat in Belgium in 1929 [ibid., ix, p. 768], has also attacked spelt wheat. A tobacco disease closely resembling wildfire [*Bact. tabacum*: ibid., x, p. 62] was observed in the valley of the Semois [ibid., x, p. 503]. Hothouse palms developed a canker at the base of the pseudostem near the collar, associated in some instances with a *Nectria* and in others with *Colletotrichum*

*allescheri*; other hothouse palms showed a rot of the terminal bud due to a *Pythium* or a *Phytophthora*.

Other records included *Sphaeropsis malorum* [*Physalospora cydoniae*] on apple branches, *Phacidiella discolor* killing pear branches [ibid., vii, pp. 646, 700], *Verticillium albo-atrum* causing apoplexy of plums [cf. ibid., v, p. 586; x, p. 150] in the valley of the Meuse, and a red spotting of the pericarp of gooseberries due to *Corticium centrifugum* [ibid., x, p. 38].

FAES (H.). **Station fédérale d'essais viticoles à Lausanne et Domaine de Pully. Rapport annuel 1931.** [Annual report for 1931 of the Federal Viticultural Experiment Station at Lausanne and Domaine de Pully.]—*Ann. Agric. de la Suisse*, xxxiii, 3, pp. 153–169, 9 figs., 1932.

This report, which is on the same lines as those for previous years [cf. *R.A.M.*, xi, p. 24], contains among many others the following items of phytopathological interest.

Owing to the low temperatures that prevailed, downy mildew of the vine [*Plasmopara viticola*] did not cause much damage in the vicinity of Lausanne in spite of heavy rains during July and August, 1931; energetic control measures were effected, seven applications of Bordeaux mixture and two of sulphur dust being given in the Domaine de Pully.

Further investigations into coître (*Coniothyrium diplodiella*) definitely established the fact that the fungus retains its germinative capacity and virulence for at least twelve years [ibid., xi, p. 692]. Late scab (*Venturia*) [*inaequalis*: ibid., x, p. 801] on harvested apples [see below, p. 32] was definitely reduced by spraying the trees with lime-sulphur mixtures late in the season (up to 15th September) to prevent infection of fruit still on the trees. Wrapping the fruit in oiled paper or silk was quite unavailing, even when the apples were buried in peat. Numerous rot-producing fungi (*Penicillium*, *Botrytis*, and *Gloeosporium* spp.) were found to effect an entry into stored apples in January and February through lesions caused by scab. The incubation period of the mycelium of *V. inaequalis* in affected apples in storage may extend to one month or six weeks.

MCDONALD (J.). **Annual Report of the Senior Mycologist for 1931.**—*Ann. Rept. Dept. of Agric. Kenya for the year ended 31st December, 1931*, pp. 118–130, 1932.

In laboratory cultural work on the strains of *Colletotrichum coffeanum* [*Glomerella cingulata*] which in Kenya Colony cause, respectively, coffee berry disease [*R.A.M.*, xi, p. 159] (the major disease of coffee in the Colony, where the losses sustained from it are considerable), brown blight, and scab (an intrinsically unimportant, extremely superficial, small buff spot on green coffee berries, affecting only small portions of the pulp), mutations of all these strains were obtained, but in no instance did the brown blight strain or the scab strain give rise to that causing berry disease. The coffee bug (*Antestia lineaticollis*) was prevalent in several localities in which the internal coffee bean rotting due to *Nematospora coryli* was commonly found [ibid., xi, p. 698].

A new physiologic form, K4 [see below, p. 13], of wheat black rust [*Puccinia graminis*: ibid., x, p. 296; xi, p. 159] was found at Ula in June and at Nairobi in August, to which Kenya Governor and Kenya Standard wheats were susceptible under favourable conditions.

Black chaff [*Bacterium translucens* var. *undulosum*: see below, p. 13] appears to be present in many parts of Kenya. Take-all (*Ophiobolus graminis*), recorded in Kenya for the first time in the period under review, was present at altitudes of over 8,000 ft.; it persists in the soil on grasses and cereals, but in the absence of these hosts it does not survive long. Root disease of wheat (*Helminthosporium sativum*), also a new record, was associated with numerous species and strains of weakly parasitic fungi.

*Fusarium moniliforme* var. *conglutinans* was commonly present in root, stalk, and ear rots of maize; many strains and possibly several species of *Fusarium* were associated with ear and root rots of this host.

*Pythium aphanidermatum* was isolated from sixteen months-old sisal [*Agave rigida* var. *sisalana*] showing shrinking and blue discoloration of the leaf bases; the affected plants had been subjected to waterlogged soil conditions during a period of exceptionally heavy rainfall the previous year.

Bacterial blight of beans [*Phaseolus vulgaris*], due probably to *Bacterium phaseoli* [ibid., xi, p. 618 and above, p. 1], was recorded for the first time.

During the height of an invasion by locusts (*Locusta migratoria migratorioides* Rch. & Frm.) many of the insects were killed off by *Empusa grylli* Fresen. [ibid., viii, p. 380].

The prohibition of the cultivation of all sugar-cane varieties other than Uba in force for three years in the Kisuma-Londiani area on account of mosaic [ibid., v, p. 576; vii, p. 12] was allowed to lapse, growers being advised, however, to restrict their planting to P.O.J. canes.

New records other than those noted above included *Ganoderma lucidum* on living plum trees [cf. ibid., x, p. 138], *Corticium salmonicolor* on orange [ibid., viii, p. 549], and *Septoria* [*Mycosphaerella*] *rubi* on raspberries.

LEACH (R.). **Report of the Mycologist.**—*Ann. Rept. Dept. of Agric., Nyasaland, 1931*, pp. 47–50, 1932.

During the period under review most of the plant disease research work conducted in Nyasaland was confined to further investigations of tea diseases [cf. *R.A.M.*, xi, p. 805].

'Gnarled' canker is now suggested as a more appropriate name for the condition hitherto known in Nyasaland as stem canker, which resembles the Indian disease of the same name but differs from the form of stem canker found in Ceylon. It occasionally causes trouble in the field, but is more serious in the nurseries, where its incidence appears to be correlated with certain soils.

The sporing stage of the organism causing violet root disease of tea [ibid., viii, p. 203] was discovered and proved to be more closely related to *Helicobasidium compactum* Boedijn [ibid., x, p. 562] than to *H. longisporum* which had been previously

suggested [ibid., x, p. 707]. The fructification is a flat, velvety growth a few mm. thick, girdling the stem and occasionally the lower branches and leaves a few inches from the ground. It is entirely superficial. During the dry season the surface remains sterile, but when the rains begin the fungus grows a new mat superimposed on that of the previous season. Before sporulation starts the new growth shows up distinctly in purple patches with a faint brown tinge against the background of the old tissues. As the plants show no apparent sign of violet root until it is too late to apply soil disinfectants, and as infection is generally so unevenly distributed through the nurseries that systematic trenching is impracticable, once the disease has appeared control is very difficult. If, however, an isolated area of affected bushes is present, a trench should be dug round it, care being taken to leave a wide margin of plants which while apparently healthy may be affected in the roots. In a patch of uncleared forest surrounding a nursery which had been severely attacked the previous year threads of the violet root fungus were found on various living roots; two or three plants of one [unnamed] species had been killed by the fungus, the roots being dry and brittle and covered with a purple mat of hyphae with distinct infection cushions.

The root disease of tea caused by *Armillaria* [*mellea*: ibid., viii, p. 202] is a constant source of trouble in Nyasaland, especially on newly opened land. It is more difficult to control in young clearings than in old ones, probably because in the latter the roots of the original forest trees have for the most part decayed. In old tea gardens the disease spreads slowly, and besides digging out the dying plants, a trench should be made round the diseased patches, leaving a margin inside of at least one row of apparently healthy plants. The roots left in the soil during clearing are a constant source of infection to the young tea until they are destroyed by desiccation and should be dug out and burnt if they start the disease.

The 1931 season was marked by severe drought, and some tea plants, especially those rather heavily pruned, suddenly died after coming away well from pruning; the roots of all these were extensively penetrated by *Rhizoctonia bataticola* [*Macrophomina phaseoli*].

The under surface of the leaves of green gram (*Phaseolus mungo* var.) showed dark brown, angular, interveinal spots consisting of a velvety growth of a fungus resembling *Heterosporium*; the conidiophores measured 90 $\mu$ in length, and the elongated, 1- to 5-septate, slightly constricted, light brown conidia were 34 to 45 by 7 $\mu$. Growth in cultures was exceedingly slow.

Chindumba plants (*Echinochloa frumentacea*) [*Panicum frumentaceum*] were attacked by a fungus resembling both *Ustilago panici-frumentacei* and *U. paradoxa*, and possibly a hybrid.

Lemon trees were attacked by collar crack due to *Armillaria* [*mellea*].

[MARTYN (E. B.).] **Botanical and mycological investigations.**—*Admin. Rept. Director of Agriculture British Guiana for the year 1931*, pp. 27–28, 1932.

In 1931, a non-infectious chlorosis slightly affected a few seed-

ling sugar-canes in the Corentyne district of British Guiana; the condition resembled that attributed in other countries to manganese deficiency. Inoculation experiments with the *Fusarium* associated with the rice disease known locally as 'man rice' [*R.A.M.*, x, p. 361] showed that it is able to kill seedling plants under conditions favourable to the fungus. The disease is less severe than the apparently similar one reported from Madras [ibid., x, p. 336].

SHERBAKOFF (C. D.). **Plant pathology.**—*Forty-fourth Ann. Rept. Tennessee Agric. Exper. Stat. for 1931*, pp. 50–54, 1932.

Four applications of 2–4–50 Bordeaux mixture, beginning about 1st May, gave as good control of cherry leaf spot [*Coccomyces hiemalis*: *R.A.M.*, x, p. 741] as seven, lime-sulphur and flotation sulphur being less effective.

The omission of sulphur from early peach sprays was found to increase the risk of scab [*Cladosporium carpophilum*]. The use of lead arsenate with flotation sulphur, either without lime or with the same amount of lime as of sulphur, caused foliage injury in peaches which was noticeably severe on poorly developed trees. The application to peaches of a sulphur spray without lead arsenate shortly before harvest gave temporary protection against brown rot [*Sclerotinia americana*: ibid., xi, p. 661].

A species of *Cercospora* (? *C. nicotianae*) was isolated from spherical green spots, about ¼ in. in diameter, on cured Burley tobacco leaves. As a rule this trouble is of minor importance, but in 1931 the spotting was extensive.

In the section on horticulture (pp. 48–50), B. D. Drain states that *Pyrus calleryana* continued to resist fireblight [*Bacillus amylovorus*: ibid., viii, p. 292] and may be used as a stock for susceptible pear scions.

S. H. Essary gives a note (in the botany section: pp. 26–34) on the methods of testing red clover [*Trifolium pratense*] for resistance to anthracnose [*Kabatiella caulivora*: ibid., xi, p. 768], studies on the inheritance of which are in progress.

Experiments in the control of tomato leaf spots [*Septoria lycopersici* (ibid., iv, p. 336) and other fungi] indicated that good results may be obtained by seed-bed and cold frame soil disinfection with 1 per cent. acetic acid, supplemented by spraying with 5–5–50 Bordeaux mixture or dusting with copper-lime, the latter giving the larger yield of fruit. No sign of resistance was given by any of the varieties used in the tests, namely, Marglobe, Tennessee Pink, Tennessee Red, Gulf State, Break o' Day, and Norduke, and little is to be expected from selection for this purpose.

**A year's progress in solving farm problems of Illinois 1930–31.**—*Forty-fourth Ann. Rept. Illinois Agric. Exper. Stat. for year ended June 30, 1931*, 304 pp., 45 figs., 15 diags., 6 graphs, 1931. [Received November, 1932.]

The following are a few of the references of phytopathological interest in this report. Ear rot of maize was found by B. Koehler to be three times as severe (17·3 per cent.) in sowings made on 31st May as in those on the 1st (5·4). The losses from ear rots

have averaged 7·5 per cent. of the crop in the Station farm investigations for the seven years from 1924 to 1930 and were 9·4 per cent. in the last year, primarily due to *Diplodia zeae* and *Fusarium moniliforme* [*Gibberella moniliformis*], the latter being responsible for the increased infection in late sowings [*R.A.M.*, x, p. 644]. Artificial drying of maize seed-grain in the Carrier air-conditioning apparatus at 110° and 130° F. was found to kill 90 per cent. of the *G. moniliformis* present, without injuring *D. zeae* or *Penicillium*.

It has again been found advisable in H. W. Anderson's tests to substitute flotation sulphur for lime-sulphur in the apple scab [*Venturia inaequalis*] schedule where the latter preparation is liable to cause injury [see below, p. 29], but under ordinary conditions lime-sulphur may safely be used for the pre-bloom applications. V. W. Kelly and M. D. Farrar found that serious yellowing of Delicious and Jonathan apple foliage followed the application of a 2 per cent. saturated oil of 83 viscosity.

H. W. Anderson reports a continuous increase in the prevalence of apple measles [ibid., xi, p. 248] on the Red and Golden Delicious, Starking, Wealthy, Jonathan, and Grimes varieties. In one orchard 25 per cent. of the trees died from this cause within two years after planting.

In addition to the Lloyd and Blair Forcing tomato varieties [ibid., x, p. 416], No. 1001 (a cross between Grand Rapids Forcing and Marglobe) has shown resistance to wilt [*Fusarium lycopersici*] in the tests of W. A. Huelsen, M. C. Gillis, and W. H. Michaels, while C. E. Durst has obtained good results with Century.

**Plant pathology.**—*Forty-fourth Ann. Rept. Arkansas Agric. Exper. Stat. for the year ending June 30, 1932* (*Bull.* 280), pp. 54–58, 1932.

The following items of interest, in addition to those already noticed from other sources, occur in this report. According to W. H. Young and C. K. McClelland, complete control of oat smut [*Ustilago avenae*] was obtained by treatment of the seed-grain with iodine dissolved in carbon disulphide [*R.A.M.*, x, p. 22].

Seedling blight of rice (*Helminthosporium oryzae*) [*Ophiobolus miyabeanus*: ibid., xi, pp. 159, 536] was found by E. M. Cralley to be most severe at a temperature range of 18° to 22° C. In experimental plots the most serious damage occurred on plants sown during the latter part of April, when the soil temperatures are still relatively low. All varieties so far tested, including Early Prolific, Fortuna, Rexora, Supreme Blue Rose, Edith, and Calora Japan, are susceptible to *H. oryzae*. The first four varieties, together with Honduras and Lady Wright, are also susceptible to stem rot (*Sclerotium oryzae*), to which some of the less productive foreign sorts, such as Aikoku, Kameiji, and Spain Jap, are fairly resistant. Regular flooding treatments have given satisfactory control of this disease.

Only one live pear bud out of several hundreds examined by H. R. Rosen was found to contain viable blight (*Bacillus amylovorus*) bacteria after overwintering [ibid., xi, p. 160]. As in previous years, no infectious exudate from overwintered cankers

was found in 1932 before the appearance of the first spring blight [cf. ibid., xi, p. 111]. Assuming that the honey bee is at least partially responsible for the initial dissemination of blight on blossoms, a weak Bordeaux mixture has been applied during the past few years to fully open flowers with promising results. Further studies on an apple and pear disease simulating fireblight and characterized by blighting of blossoms and (in artificial inoculations) of twigs, and leaf spotting, indicated that a different bacterial pathogen is responsible for these symptoms.

BURTON (G. J. L.). **Annual Report of the Senior Plant Breeder for 1931.**—*Ann. Rept. Dept. of Agric. Kenya for the year ended 31st December, 1931*, pp. 176–201, 1932.

In a comparative yield test of wheat varieties carried out during the period under review at the Njoro Plant Breeding Station, Kenya, all the plants of every variety used were destroyed by black chaff [*Bacterium translucens* var. *undulosum*: *R.A.M.*, xi, p. 163], the grain being so shrivelled that it could not be threshed. Take-all [*Ophiobolus graminis*] has spread considerably at the higher altitudes in Kenya, and in 1931 seriously reduced the yields.

A table is given showing the reaction of ten wheats grown in Kenya to the four physiologic forms (K1, K2, K3, and K4) of black rust [*Puccinia graminis*] now known to be present in the colony [see above, p. 9]. Of the crosses made to improve the milling standard while retaining resistance to black rust and yellow rust [*P. glumarum*], the most important families at the Njoro Station are Nos. 117, 122, 112, 135, 136, 143, and 130, No. 112 being perhaps the most promising. It is thought that the inheritance of resistance to form K2 is not dependent on a single factor as is the inheritance of resistance to forms K1 and K3, so that it is difficult to obtain resistance to all the forms together. These new wheats would be suitable for all districts in Kenya except those with two short rainy seasons. Field experiments in 1930 and 1931 showed clearly that more than one physiologic form of leaf [brown] rust [*P. triticina*] is habitually present in Kenya and that Kenya Standard wheat is susceptible to them, while B. $F_4$. 3. B. 10. V. 1 (L) is resistant. Crosses (now in the $F_4$ generation) between these two wheats have given several very resistant forms and as Kenya Standard is resistant to all four forms of black rust, these crosses are being fully tested at the Scott Agricultural Laboratories Plant Breeding Station, where the work is mainly to improve on Kenya Standard in regard to resistance to brown rust, yield, and grain quality.

The maize breeding to be carried out by C. Maher at Trans Nzoia is expected to produce more definite results than that hitherto conducted in Njoro, as the objects of the work in the former locality are more definite (studies of resistance to *Helminthosporium turcicum* [ibid., x, p. 297] and *Fusarium* diseases) and the ordinary mixed maize crop is more susceptible to these fungi there than elsewhere. The material available at Trans Nzoia at the beginning of the 1931 season included 17 self-fertilized cobs resistant and 4 susceptible to *H. turcicum*.

NEWTON (MARGARET) & JOHNSON (T.). **Studies in cereal diseases. VIII. Specialization and hybridization of Wheat stem rust, Puccinia graminis tritici, in Canada.**—*Canada Dept. of Agric. Bull.* 160, N.S., 60 pp., 16 figs., 7 diags., 4 graphs, 1 map, 1932.

Most of the information in this paper is based on investigations previously reported in connexion with the specialization and hybridization of wheat stem rust (*Puccinia graminis tritici*) in Canada [*R.A.M.*, xi, pp. 437–439, *et passim*].

During the period from 1919 to 1930, 41 physiologic forms of the rust were isolated from cereals and grasses. Until 1926 all the forms found were identified as one or other of those described in the United States by Stakman and his collaborators, but since that year a number of distinct forms have been isolated in Canada. Different physiologic forms have been shown to predominate in different years. Thus, from 1919 to 1921, form 17 was the most prevalent, 21 occurring seldom, whereas from 1922 to 1929 the reverse was the case. Other forms, e.g., 24, appeared once or twice and then remained absent for a number of years, while 11 developed so consistently over a long period as to be regarded as semi-permanent and then suddenly disappeared for a considerable time. Since 1925 form 36 has predominated. Most of the damage to Canadian wheat seems to be caused by forms 36 and 21, which comprised over 50 per cent. of the 2,171 isolations made during the period under review, while 38, 17, and 49 are also involved to a lesser extent. All these forms are characterized by long uredospore-producing periods and consequently have a much better chance of survival than those with correspondingly short periods, such as forms 83, 53, 48, and 33.

In Eastern Canada and in British Columbia, where barberries are fairly common, a proportionately larger number of new physiologic forms have been isolated than in the great central wheat plain of the prairie Provinces, which contains practically no barberries. Some correlation was also observed between the introduction of new varieties of wheat into a district and the occurrence in the latter of physiologic forms not previously found there.

A temperature of 65° F., in conjunction with a moderate light intensity such as prevails in spring and autumn, has been found satisfactory for the testing of physiologic forms of *P. graminis tritici* with a view to their determination.

Although the Mendelian laws of inheritance appear to be operative in all the crosses between physiologic forms of the rust investigated, considerable evidence is available that in some of these the cytoplasm of the parent forms influences the inheritance of pathogenicity.

COTTER (R. U.). **Factors affecting the development of the aecial stage of Puccinia graminis.**—*U.S. Dept. of Agric. Tech. Bull.* 314, 37 pp., 5 pl., 1932.

A comprehensive account is given of the writer's studies in Minnesota on the factors affecting the development of the aecidial stage of wheat stem rust (*Puccinia graminis tritici*).

A list is given of the susceptible and immune species and varieties of *Berberis*. A correlation was indicated, in the progeny of a cross between *B. vulgaris* and *B. thunbergii*, between the inheritance of some morphological characters of the former and susceptibility to *P. graminis* [*R.A.M.*, xi, p. 628].

The teleutospores of the rust were found to remain viable for at least 18 months under dry conditions at a temperature near freezing-point; they very rarely germinate above 26° C., and a range of 12° to 21° gave the most favourable results in teleutospore germination, barberry infection, and aecidial production.

The minimum period required for barberry infection by teleutospores was 21 hours, except in a moist chamber where exposure to a shower of sporidia resulted in infection in five hours. The leaves (up to 16 days old), stems, spines, petioles, sepals, and berries of *B. vulgaris* are all liable to infection.

The aecidia of *P. graminis* may discharge aecidiospores 37 days after their formation, and the aecidiospores are capable of infecting rye up to 46 days after the first appearance of the aecidia.

A study of the physiologic forms of *P. graminis tritici* isolated from *Berberis* spp. (including *B. canadensis* and *B. declinata* [var.] *oxyphylla*) inoculated with teleutospores from Red Sask wheat showed that forms 18 and 35 were associated five times, 21 and 33 four times, 18 and 33 twice, 21 and 35 three times, and 34 and 35 once. Forms 34, 36, 51, and 52 appeared only once in the course of the investigations [cf. preceding abstract].

HASSEBRAUK (K.). **Zur Bewertung der Saugkraft als Merkmal von Braunrostbiotypen.** [On the utilization of osmotic force as a character of brown rust types.]—*Phytopath. Zeitschr.*, v, 2, pp. 173–177, 1932.

In order to test the validity of Steiner's conclusions as to the importance of the osmotic force of the uredospores of brown rust of wheat (*Puccinia triticina*) as a differential character of the various physiologic forms [*R.A.M.*, ix, p. 705], the writer repeated the experiments during 1931–2 with the same forms (XI, XIII, and XIV) under identical conditions, except that fresh uredospores were used instead of stored ones.

The spores were germinated in cane sugar solutions of 0·3 to 0·6 mol., and also in water for control purposes, on three dates each in November and February and on one in March. The average germination of form XI at 0·3 and 0·6 mol. throughout the period was 67·1 and 10·7 per cent., respectively, compared with 73·5 per cent. in water, the corresponding figures for XIII being 49·4, 3·7, and 67·7 per cent., respectively, and for XIV, 59·8, 7·6, and 70·5 per cent., respectively. These figures differ widely from those obtained by Steiner, who also found that the maximum sugar concentration permitting germination was 0·55 to 0·6 mol., whereas in the present tests the limit was near 0·65; according to Stock [ibid., x, p. 587], isolated germination occurs in a 1 mol. glucose solution. In view of these discrepancies it is held that the osmotic force of the uredospores is not a reliable criterion for the differentiation of the physiologic forms of *P. triticina*.

SCHILCHER (E.). **Über die Lebensdauer der Uredosporen Puccinia triticina.** [On the longevity of the uredospores of *Puccinia triticina.*]—*Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz.*, xlii, 9, pp. 465–467, 1932.

The results [which are briefly described] of germination tests with the uredospores of brown rust of wheat (*Puccinia triticina*) in the laboratory at the Vienna Plant Protection Institute (temperature range 9° to 22° C.), showed that the viability of material collected in September is fully maintained for at least six months, whereas in the spring and early summer the spores lose their power of germination after three months [*R.A.M.*, xi, p. 32]. The tests were carried out by using spore material, collected from a number of different localities and kept in dry Petri dishes protected from direct sunlight, to inoculate wheat.

SEIDLER (F.). **Selbstanfertigung eines Trockenbeizapparates.** [A home-made dusting apparatus.]—*Wiener Landw. Zeit.*, lxxxii, 33, p. 259, 2 diags., 1932.

A satisfactory dusting apparatus for the disinfection of cereal seed-grain may be constructed with a calcium cyanamide drum of corrugated tin encircled round the middle of the long axis by two half-hoop iron bands, one of which is bent out at the ends to form supports enabling the drum to be revolved on a median axis parallel with the ends of the cylinder. A crank is affixed to one of the drawn-out ends of the encircling band and the entire machine is mounted on a strong wooden block. The capacity of a drum of this type is 25 kg. and the mixing process takes about five minutes.

**Die Beizung des Saatgutes.** [Seed disinfection.]—*Wiener Landw. Zeit.*, lxxxii, 33, p. 259, 1932.

Attention is drawn to the great value of ceretan as a disinfectant dust for the control of seed-borne diseases of cereals in Austria, e.g., *Fusarium* [*Calonectria graminicola*] of rye, wheat bunt [*Tilletia caries* and *T. foetens*], and barley stripe (*Helminthosporium gramineum*). This preparation is officially recommended by the Federal Institute of Plant Protection for use at the following rates: 100 gm. per kg. for wheat, beans, and peas, 150 gm. for barley and spelt, 200 gm. for oats, and 300 to 400 gm. for beet.

HÜTTIG (W.). **Die Grundlagen zur Immunitätszüchtung gegen Brandpilze (Ustilagineen). (Sammelreferat.)** [The foundations for breeding for immunity from smut fungi (Ustilagineae). (A comprehensive survey.)]—*Der Züchter*, iv, 9, pp. 209–219, 24 figs., 3 graphs, 1932.

A résumé is given of the principal recent studies forming the basis of breeding for immunity from various cereal smuts. Most of the papers cited have been noticed in this *Review*.

HÜTTIG (W.). **Über den Einfluss der Temperatur auf die Keimung und Geschlechtverteilung bei Brandpilzen.** [On the

influence of temperature on germination and sex distribution in the smuts.]—*Zeitschr. für Bot.*, xxiv, 10–11, pp. 529–557, 26 figs., 1931.

The author has tested the effect of temperature on the germination of nine species of *Ustilago*, including *U. avenae*, *U. hordei*, *U. nuda* f. sp. *tritici* [*U. tritici*] and *U. zeae.* *U. avenae* failed to germinate in seven days at $-1°$ C., germinated to the extent of 2 per cent. at zero, and increased to 98 per cent. at the optimum at 20°, falling to 60 per cent. at 30° and failing to germinate at 35°. *U. hordei* gave 30 per cent. germination at $-1°$, 99 per cent. at 10°, 50 per cent. at 30°, and failed to germinate at 35°. *U. tritici* agreed with *U. avenae* in general, while *U. zeae* was somewhat similar at the lower temperatures but had its optimum at 30°. The characters of the promycelium were affected at the lower temperatures, at which all four species budded off sporidia or promycelial segments, which were sometimes 2-celled, from the apex of a short single basal cell (*U. longissima* type of germination). In fact, according to the temperature, it was possible to secure in all the species tested the four common types of promycelial formation known in the genus.

The influence of temperature on the reduction division and segregation of characters was tested on numerous isolations of the individual sporidia at different temperatures and was found to affect these. Characters such as the form and colour of the resulting colonies were found to be segregated independently of the sex characters.

Krause (A.). **Über Weizenbrand und Weizensorten.** [On Wheat smut and Wheat varieties.]—*Wiener Landw. Zeit.*, lxxxii, 33, pp. 258–259, 1932.

A brief, popular note on the occurrence and control of wheat bunt [*Tilletia caries* and *T. foetens*] and loose smut [*Ustilago tritici*] in Austria [*R.A.M.*, vi, p. 531] is followed by an account of a varietal experiment in connexion with the first-named disease. In 1928 the incidence of bunt on Kolben [Club] wheat was 10 per cent. while Loosdorf awned remained completely free from infection. In 1929 both varieties were treated with germisan, in spite of which Kolben again showed 25 per cent. bunt and Loosdorf practically none. In the following year the seed-grain was disinfected with uspulun at the maximum concentration, but nevertheless Kolben developed 50 per cent. or more bunt, Loosdorf again being immune. In the wet year 1929 Kolben gave a higher yield than Loosdorf, the latter being more prolific in the relatively dry seasons of 1928 and 1930. Other varieties from the south-east giving equally satisfactory results in another test were the Hungarian Kadolz and Banat, which showed next to no bunt in proximity to heavily infected (80 per cent.) Kolben.

Smith (R. W.). **Transferring smut immunity to hard red spring Wheat.**—*Journ. Amer. Soc. Agron.*, xxiv, 8, p. 662, 1932.

In 1927 Komar, a hard, red spring wheat, resistant to rust [*Puccinia graminis*], was crossed with Hussar, a hard, red winter wheat immune from certain physiologic strains of bunt (*Tilletia*

*levis* and *T. tritici*) [*T. foetens* and *T. caries*: *R.A.M.*, xi, p. 442]. The $F_1$ plants, unsmutted, were grown in the greenhouse at Arlington, Virginia, during the following winter, while the $F_2$ and succeeding generations were grown in the nursery at Dickinson, North Dakota, using smut-inoculated seed. About 4 per cent. of the plants developed bunt in the $F_2$, 5 per cent. in the $F_3$, none in the $F_4$, and only 1 in 3,241 in the $F_5$ generation. In the same tests Komar showed 24 to 42 per cent. of infection each year and Hope 1 to 3 per cent. Seed of 19 $F_5$ plants from bunt-free families was inoculated and grown in a greenhouse under favourable conditions for infection. No bunt was detected in the 19 hybrids, though every head of Komar was diseased. It would appear, therefore, that the immunity of Hussar from bunt has been transferred to a hard, red spring wheat by crossing, it is believed for the first time.

JARRETT (PHYLLIS H.). **Investigations of flag smut of Wheat.**—*Journ. Australia Council Sci. & Indus. Res.*, v, 3, pp. 165–169, 1 pl. [facing p. 189], 1932.

After a brief account of the biology and symptoms of flag smut (*Urocystis tritici*) of wheat [*R.A.M.*, x, p. 782], and of its geographical distribution, the author describes at some length greenhouse and field experiments in 1931 and 1932 to test the relative resistance to it of 40 (named) varieties of wheat, and also the effect of infection on their yield. Seed infection tests, in which the seed grain was presoaked for 8 to 12 hours, according to the variety, in a shallow dish of water on the surface of which smut spore balls had been soaked for about three days at 18° to 23° C., showed that none of the varieties or crosses so far tested was wholly and consistently immune from infection. Some of them, however, e.g., Bomen, Bunyip, Cedar, Galgalos, Geeralying, and Nabawa, showed a high degree of resistance. The yield tests will be reported later.

HENRY (A. W.). **Influence of soil temperature and soil sterilization on the reaction of Wheat seedlings to Ophiobolus graminis Sacc.**—*Canadian Journ. of Res.*, vii, 2, pp. 198–203, 1 pl., 2 graphs, 1932.

In the experiments briefly described in this paper Marquis wheat seedlings, grown in sterilized and unsterilized soil, were equally severely attacked at low temperatures (up to 20° C.) when inoculated with a virulent strain of *Ophiobolus graminis* [*R.A.M.*, xi, p. 708]. At higher temperatures, on the other hand, the intensity of attack by the fungus decreased in unsterilized soil (at 27° most of the seedlings were very slightly affected), while it remained practically unchanged in sterilized soils. These results would indicate, in the author's view, that the protective value to wheat of the soil saprophytes [ibid., x, pp. 448, 719; cf. also xi, p. 361] against soil-borne infection with *O. graminis* is relatively small at temperatures below 20°. Observations during the past 10 years show that take-all is much more destructive to spring wheat in western Canada than in the United States, possibly because of the lower soil temperature during at least part of the growing season in the

former region. Winter wheat is severely injured in both areas and is normally exposed to low temperatures in both.

MORITZ (O.). **Weitere Studien über die Ophiobolose des Weizens.** [Further studies on ophiobolosis of Wheat.]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xx, 1, pp. 27–48, 11 figs., 1932.

Continuing his studies on the occurrence of foot rot (blackleg) of wheat in Schleswig-Holstein [*R.A.M.*, x, p. 512], the writer again found the bulk of infection to be due to *Ophiobolus graminis*. The other well-known agents of the disease, *Leptosphaeria herpotrichoides* and *Wojnowicia graminis*, were absent and only in a few cases was *O. herpotrichus* detected by Dr. Pape.

Inoculation experiments with three strains of *O. graminis* resulted in more or less heavy infection on Carsten V winter wheat, Garnet summer wheat, Peragis, Reward, red Bordeaux, *Triticum monococcum* [var.] *hornemanni*, *T. persicum*, *T. turgidum* var., *T. compactum* var., Friedrichswerther Berg winter barley, Heine's Hanna summer barley, Mahndorfer Viktoria white oats, Petkus summer rye, *Vicia sativa*, Feddersen Rosenhof broad beans (*V. faba*), Victoria peas, and red clover (*Trifolium pratense*). The most virulent strain was one isolated by the writer in 1929. The symptoms produced by *O. herpotrichus* on Peragis wheat resembled those described by van de Laar in Holland [ibid., x, p. 446]. Comparative tests with *Fusarium culmorum* gave negative results. The experiments of Sanford and Broadfoot in Canada [cf. preceding abstract] showed the inhibitory effect of other soil-inhabiting micro-organisms on the development of *O. graminis*, and the importance of this factor was further demonstrated by the writer's inoculation tests with the virulent strain of the fungus on *T. persicum* in various sterilized and unsterilized soils. The highest percentage of infection (88) was obtained on sterilized marsh soil ploughed for the first time in 1926, and the lowest (18) on unsterilized black soil from the island of Fehmarn. The greatest risk of natural infection, however, occurs on the high heathland (' Geest '), in two unsterilized pots of which 68 and 75 per cent. of foot rot were obtained. It is concluded that while blackleg of wheat is primarily caused by fungal infection (from which the author found no variety to be immune), the liability to the disease depends in great measure on soil (including biological) factors. The possible applications of these data to a system of control based on manuring, soil treatment, and crop rotation are discussed.

LUNDEGÅRDH (H.). **Om gråfläcksjuka och liknande bristsjukdomar hos kulturväxter.** [On the grey speck and analogous deficiency diseases among cultivated crops.]—*Landtmannen Tidskr. for Landtmän*, xv, 38, pp. 775–777, 4 figs., 1 map, 1932.

A popular account is given of the grey speck disease of oats [cf. *R.A.M.*, xi, p. 295] in Sweden, where it has also been observed on barley, wheat, root crops, and flax. The most susceptible variety of oats in an official test was Dala, Mesdag being resistant and Seger intermediate. The disease is most prevalent in districts

where an excessively high lime content of the soil prevents the proper utilization by the plants of the potash and manganese necessary to their development; among such localities are north-west Skåne, Öland, certain parts of west and east Gothland, and Blekinge. An abundance of dry mould or of colloids, e.g., of iron, aluminium, or silicic acid, in the soil is also favourable to the disorder. The simplest and most direct means of combating grey speck is by the application of manganese sulphate in quantities not exceeding 50 kg. per hect., but in most cases this measure is likely to be prohibitively expensive. The requisite amounts of manganese may be released and rendered available to the plants by a dressing of ammonium sulphate [cf. ibid., vii, p. 470]. Applications of nitrates (e.g., saltpetre or calcium nitrate) are definitely injurious to crops on soils where grey speck is prevalent, and the nitrogen must be provided in the form of ammonia. Good yields may be obtained by the sulphate of ammonia treatment even where the natural supply of manganese is small (15 to 20 mg. per kg. soil). It is seldom that Swedish soils are so poor in this mineral as to necessitate direct applications of it. Great care should be taken to avoid an excess of lime in the soil, since this is the main factor preventing the assimilation of manganese. In places where the subsoil contains more manganese than the surface layers, deep ploughing is advisable.

Săvulescu (T.) & Rayss (T.). **Der Einfluss der äusseren Bedingungen auf die Entwicklung der Nigrospora oryzae (B. und Br.) Petch.** [The influence of external conditions on the development of *Nigrospora oryzae* (B. et Br.) Petch.]—*Phytopath. Zeitschr.*, v, 2, pp. 153–172, 4 figs., 2 graphs, 1932.

This is a considerably expanded account of the writers' studies on the influence of external conditions on the development in pure culture of *Nigrospora oryzae*, a parasite of maize in Rumania, a condensed version of which has already been noticed [*R.A.M.*, xi, p. 711].

Reichert (I.) & Hellinger (E[sther]). **Further experiments on the control of Diplodia stem-end rot of Citrus fruits by debuttoning.**—Reprinted from *Hadar*, iv, 10, 8 pp., 1931. [Received October, 1932.]

Continuing their investigations on the control of the stem-end rot of citrus due to *Diplodia natalensis* in Palestine [*R.A.M.*, xi, p. 508], the writers found that the losses from this disease are increasing. The amount of infection in fruit stored on the spot during 1930–1 was 4·9 per cent., and it was probably higher in exported lots. The fungus was completely removed by debuttoning, either after colouring with ethylene gas ($1\frac{1}{2}$ to 3 days at 21° to 22° C.) or after wilting for four days in the packing-house, both measures rendering the 'button' [fruit stalk and receptacle] easy to detach by slight pressure. In one experiment not a single fruit out of 505 that were debuttoned after wilting developed stem-end rot, against 39 out of 540 (7·2 per cent.) in the controls. The practical importance of this method of control is obvious, but the acceptability of debuttoned fruit in the market has yet to be tested.

Reichert (I.) & Hellinger (E[sther]). **Further experiments on the control of Diplodia stem-end rot of Citrus by pruning and spraying.**—Reprinted from *Hadar*, v, 6, 6 pp., 2 graphs, 1932.

Further experiments during 1930–1 were directed to testing the effect of pruning and spraying on the control of stem-end rot of citrus (*Diplodia*) [*natalensis*: see preceding abstract] in Palestine. They confirmed the results of previous tests [*R.A.M.*, ix, p. 777] in showing that the pruning of dead wood during June or July (preferably the former) considerably reduces the incidence of infection (by over 55 per cent.). The results obtained by spraying with 1 per cent. Bordeaux mixture in addition to pruning were conflicting.

Reichert (I.) & Hellinger (E[sther].). **Conditions affecting the appearance of Diplodia rot in Citrus fruits.**—*Hadar*, v, 9, pp. 203–206, 5 graphs, 1932.

An account is given of the writers' observations on the environmental conditions affecting the occurrence of stem-end rot of citrus (*Diplodia*) [*natalensis*: see preceding abstracts] in Palestine. Temperature and relative humidity were found to be important factors in the development of the fungus, which thrives in late February and March (temperature above 13° C. and relative humidity over 52 per cent.), while late December and January are nearly always unfavourable. The disease is most prevalent on heavy soils and chiefly affects the fruits on the lower parts of the tree, though the upper ones may also be involved to a considerable extent. Infection by *D. natalensis* was considerably increased by the presence of *Penicillium digitatum* and *P. italicum* on over-ripe fruit (picked in March). In inoculation experiments *P. digitatum* increased the amount of *Diplodia* rot from 6 in the non-inoculated controls to 10 per cent., *P. italicum* to 12 per cent., and both moulds combined to 15 per cent. [cf. ibid., viii, p. 237].

**Report on the Agricultural Department, Dominica, April–December, 1931.**—*Trinidad, Imper. Comm. of Agric. West Indies*, 16 pp., 1932.

During 1931, wither-tip and blossom blight of citrus (*Gloeosporium limetticolum*) [*R.A.M.*, xi, p. 284] appeared to be less prevalent in Dominica than in previous years, but the incidence of these diseases was masked by the heavy destruction of the lime trees through hurricanes and red root disease (*Sphaerostilbe repens*) [ibid., xi, p. 283]. Collar rot and kindred diseases of citrus [cf. ibid., viii, p. 500; ix, p. 628; x, p. 97] were confined mainly to seedling limes and seedling sweet oranges, though isolated attacks were also noted on budded trees where the budding had been near the bottom of the stem. Scab [*Sporotrichum citri*] was very prevalent in citrus nurseries where through its retardation of growth it caused heavy losses of stocks; sour orange [*Citrus aurantium* var. *bigaradia*] stocks were those chiefly affected.

The replanting of fields devasted by hurricanes with limes budded on stocks resistant to hurricanes and diseases is being effected rapidly and the earlier plantings have begun to fruit;

during the past four years approximately 58,000 budded limes have been distributed to growers.

Eighteen lime hybrids highly resistant to wither-tip and very closely resembling the West Indian lime have been crossed back to the West Indian, using the latter as male parent. One of the original hybrids (No. 29 Woglum hybrid) set a single fruit very similar in appearance to the West Indian lime. This hybrid, together with others, has now been reproduced by budding.

MAYNE (W. W.). **'Jeloo' and black bean in Coffee.**—*Planters' Chron.*, xxvii, 16, pp. 411–416, 1932.

The author states that the 1931–2 coffee crop in all the western districts of South India, from North Mysore to the Anamalais, was characterized by an extraordinary amount of decayed beans (locally known as black bean or 'jeloo' disease) [*R.A.M.*, iv, pp. 166, 591], causing financial losses which were estimated at a very high figure. In some cases the trouble developed even in coffee that had been thoroughly sprayed. The results of his own investigation in 1931, supported by those obtained by previous workers [loc. cit. and ibid., vi, p. 465] indicated that the condition is not primarily due to the activity of any parasitic organism, although in fallen berries secondary rots, including common saprophytic fungi, were present. In many cases, however, the fruit did not fall and showed no external sign of injury though the inner tissues were brown and soft. Healthy and rotted beans frequently occur in the same fruit. The fact that black bean occurs only in occasional years would appear to point to its being a result of unfavourable climatic conditions, and small-scale manurial experiments suggest that it may also be caused by nutritional disturbances in the plant.

STOUGHTON (R. H.). **The influence of environmental conditions on the development of the angular leaf-spot disease of Cotton. IV. The influence of atmospheric humidity on infection.**—*Ann. of Appl. Biol.*, xix, 3, pp. 370–377, 2 graphs, 1932.

The results of the experiments described in this paper [which were made with the same material and on the same lines as in the previous work: *R.A.M.*, xi, p. 297] showed that high atmospheric humidities, exceeding 85 per cent., favour the development of the angular leaf disease (*Bacterium malvacearum*) of cotton. At humidities below 85 per cent. the degree of infection decreased rapidly. From a discussion of the relation of these results to those of the experiments on the influence of air temperature [loc. cit.], the author concludes that the importance of humidity is mainly physical in nature, by affecting the time during which the droplets of moisture, allowing of the development of the bacteria, persist on the leaves of the host.

RAIFORD (T. S.). **Systemic blastomycosis with report of a case.**—*Bull. Johns Hopkins Hospital*, li, 2, pp. 61–82, 10 figs., 1932.

Full details are given of a fatal case of systemic human blasto-

mycosis with primary involvement of the skeletal system and an absence of the typical concomitant lesions generally associated with *Blastomyces* [*dermatitidis*: *R.A.M.*, xi, p. 643]. The pathological condition was markedly similar to those of tuberculosis and chronic osteomyelitis, with which systemic blastomycosis may readily be confused.

DAVIDSON (A. M.) & GREGORY (P. H.). **List of fungi infecting man in Manitoba.**—*Canadian Journ. of Res.*, vii, 2, pp. 233–235, 1932.

From this preliminary list of human ringworm fungi, including two species of *Microsporon* [*Sabouraudites* of Langeron & Milochevitch: *R.A.M.*, x, p. 243], three of *Trichophyton* [loc. cit.], and one of *Epidermophyton*, which were isolated since 1930 in two hospitals in Winnipeg, it would appear that the great majority of the clinical cases were due to members of the first-named genus, of which *M. audouini* [see next abstract] is by far the most common. *M. felineum* is provisionally taken as including *M. lanosum* [ibid., xi, p. 646].

DAVIDSON (A. M.) & GREGORY (P. H.). **A convenient source of Wood's light for the diagnosis of ringworm of the scalp.**—*Canadian Med. Assoc. Journ.*, xxvii, 2, pp. 176–177, 1 fig., 1 diag., 1932.

Since Margarot and Devèze discovered in 1925 that hairs infected with *Microsporon* or *Achorion*, when examined in the dark with ultra-violet light, fluoresce with a green light which is quite distinct from the fluorescent colour of the normal hair and skin, the quartz mercury-arc lamp fitted with Wood's glass, or some other filter capable of absorbing visible light but transmitting the longer ultra-violet rays, has been extensively used in the diagnosis of ringworm of the scalp [*R.A.M.*, x, p. 666]. A relatively inexpensive adaptation of this apparatus that can be plugged in on any ordinary circuit is the Mazda 'Photoflood' lamp with a life at 115 volts of about two hours. Two thicknesses of $\frac{3}{16}$ in. Corning Heat Resistant Red Purple Ultra glass No. 587 are used as a filter, on the outside of which is placed a plano-convex condensing lens in order to produce a concentrated beam of faint violet light. The latter is turned in a darkened room on the areas of the scalp where ringworm or favus is suspected. Patches or even single hairs infected with *M. audouini*, *M. lanosum* [see preceding abstract], and *Achorion schoenleini* emit a bluish-green light in strong contrast to the dark colour of normal hairs. The green fluorescence has not been observed by the writers in cases of infection by *Trichophyton* spp.

GRIGORAKIS (L.). **De l'action de l'éther sur les microvégétaux parasites du tissu animal (facteurs de virulence, vitalité, dégradation et mutation).** [On the action of ether on microscopic plants parasitic on animal tissue (factors of virulence, vitality, degeneration, and mutation).]—*Comptes rendus Acad. des Sciences*, cxcv, 13, pp. 555–556, 1932.

Cultures of *Rhinocladium* [*Sporotrichum*] *beurmanni* [*R.A.M.*,

xi, p. 646] exposed to the fumes of sulphuric ether for two minutes developed much more rapidly than similar cultures not so treated. Subcultures of these were similarly exposed for five minutes, and after this procedure had been repeated some ten times the colonies lost their pigment and assumed a glistening white appearance, very few conidia were formed, and virulence for laboratory animals was lost. It would appear from these experiments that mutation may accompany vegetative deterioration in the absence of the normal reproductive cycle.

GRIMES (M.), O'CONNOR (M.), & CUMMINS (H. A.). **A study of some Phoma species.**—*Trans. Brit. Mycol. Soc.*, xvii, 1–2, pp. 97–111, 2 pl., 1932.

After a brief discussion of the taxonomy of the genus *Phoma* and its relationship to *Phyllosticta*, a description is given of two species, one of which was isolated from samples of milk, cream, butter, and water, and the other from butter alone, submitted for examination to the bacteriological department of University College, Cork. On most solid media the first produced compact, circular, flat, submerged colonies with abundant pycnidia embedded in the upper surface. The latter are globular, flask-shaped or lenticular, and measure 60 to 108 by 50 to 200 $\mu$. The pycnospores are hyaline, continuous, oblong, rounded at both ends, and 5 to 7 by 4 $\mu$; a few are rounded and 3 $\mu$ in diameter. The fact that it proved non-pathogenic on various plants tested, and that it did not agree in its cultural characters [details of which are given] with any other known member of the genus, leads the authors to consider it as new to science, and to name it *Phoma hibernica* n. sp. The cultural characters, pathogenicity to tomato and ivy, and morphology of the species isolated from butter alone indicate that it is identical with *P. destructiva* [*R.A.M.*, x, p. 414], the cross-inoculation experiments and characters of the ivy parasite usually known as *Phyllosticta hedericola* [ibid., x, p. 462] indicating that the two species are identical.

The paper includes a tentative scheme [in the form of a key] for the classification of some of the species of *Phoma* encountered by the authors, based on cultural and physiological properties.

GRIMSHAW (A. H.). **Mildewed wool. Comparison of some oil compounds for probable nutrient properties.**—*Melliand Textile Monthly*, iv, 4, pp. 253–256; 5, pp. 300–303, 9 figs., 1932.

A brief survey of some papers on mildew in textile fabrics precedes the writer's account of his investigations on this problem in American mills. Trade experience indicates that moulds are more important than bacteria as a source of injury to textiles.

The writer obtained cultures from mildewed wool in New Jersey and North Carolina in Petri dishes of various media inoculated with fragments of the wool. On agar media without oil, kept in a dark, warm place at 96° F., no mould development occurred after 264 hours. In gelatine media without oil, in a dark, cool place, mould formation (? *Aspergillus niger*) [cf. *R.A.M.*, x, p. 598] took place in 96 hours. After three weeks slight growth appeared on mildewed yarn placed in agar media plus a small amount of mineral

oil, but none where gelatine was substituted for agar. Rapid mildew development took place in gelatine or agar with olive oil emulsion at laboratory temperature. In another series of tests various wool oil compounds (1 to 3 per cent.) were added to a medium consisting of agar and tragacanth and inoculated as above, some of the dishes being covered but exposed to the light, others uncovered, while a third series was kept in containers which excluded light. Mildew occurred after two days in the nutrient medium plus a lard oil base, both in the light and dark, while traces were observed in three or four days with a strong soap base; with olive oil incipient growth took place after two days in the light and after three in the dark. After three weeks there was only a trace of mildew in the nutrient medium with a strong mineral oil base, while no growth occurred where corrosive sublimate and ammonium chloride (each at a strength of 1 in 50,000) or a mineral oil emulsion used for spraying cotton were added. In the uncovered dishes the medium dried up and no mould development took place, showing that moisture is essential for growth.

PARSONS (B.) & MASSEY (L. M.). **Rose-disease investigations. Third progress report.**—*Amer. Rose Ann., 1932*, pp. 47–58, 1932.

In the third season of field tests in Pennsylvania to determine the relative efficacy of various fungicides against black spot and brown canker of roses (*Diplocarpon rosae* and *Diaporthe umbrina*) [*R.A.M.*, x, p. 793], sulphur dusts, especially pomogreen and kolotex (both 90–10 sulphur-lead arsenate but the former dyed green), once more proved superior to the liquid treatments except Bordeaux mixture which gave better results in controlling black spot than in the two preceding years. Manganar dust (chiefly sulphur and manganese arsenate) [ibid., x, pp. 58, 389] also proved highly effective. It is thought that the relative inferiority of the sprays may be due to their failure to adhere to the waxy cuticle of the leaf. Fungicides containing sulphur were more effective against brown canker than those containing copper. The Margaret McGredy, Mari Dot, and Charles P. Kilham varieties were used in the black spot trials, and Mrs. Henry Morse and Charles P. Kilham in the brown canker tests.

OGILVIE (L.). **Brown canker of Roses in England.**—*Trans. Brit. Mycol. Soc.*, xvii, 1–2, p. 153, 1932.

The author records what he believes to be the first discovery in England of *Diaporthe umbrina* [*R.A.M.*, x, p. 666 and preceding abstract] causing a severe wilt and die-back of rose plants in Gloucestershire in 1931. The fungus, which was identified by Miss Jenkins, caused characteristic cankers on inoculated rose shoots.

FISCHER (R.). **Die wichtigsten Pilzkrankheiten der Dahlien.** [The most important fungous diseases of Dahlias.]—*Gartenzeit. Oesterr. Gartenbaugesellsch. in Wien, 1932*, pp. 6–8, 1 fig., 1932. [Abs. in *Bot. Centralbl.*, N.F., xxi, 15, p. 476, 1932.]

Notes are given on the following diseases of dahlias in Austria: (*a*) on the aerial organs: grey mould (*Botrytis cinerea*), smut

(*Entyloma dahliae*) [see next abstract], and true mildew [? *Erysiphe cichoracearum*: *R.A.M.*, iv, p. 466]; and (*b*) on the underground system: crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*), dry rot of the bulbs (*Fusarium* spp. and *Verticillium dahliae*) [ibid., xi, p. 792], and wet rot (*B. cinerea*, *Sclerotinia sclerotiorum*, and other organisms). Control measures are indicated.

Green (D. E.). **Smut disease of Dahlias caused by Entyloma dahliae (Sydow).**—*Journ. Roy. Hort. Soc.*, lvii, 2, pp. 332–339, 6 pl. (2 facing pp. 328–329), 1 fig., 1932.

A widespread spotting of dahlias at Wisley, Surrey, affecting some 274 varieties to a greater or lesser extent in 1931, was found to be due to *Entyloma dahliae* [*R.A.M.*, ix, p. 409]. The first symptoms are small, pale circular spots on the lower leaves, rapidly expanding to a diameter of $\frac{1}{16}$ to $\frac{1}{4}$ in. (sometimes up to $\frac{3}{4}$ in.), and turning brown in the centre, which may fall out. When large numbers of spots occur they may coalesce to form extensive areas of diseased tissue, and ultimately most of the leaf-blade may shrivel and die. Defoliation rapidly ensues on badly affected plants, and even in mild cases the vigour of the host is greatly impaired. The Mignon varieties suffered most from the attacks of *E. dahliae*, closely followed by the small-flowered Paeony types.

Good control of the disease was given by two applications of 4–4–50 Bordeaux mixture (8th and 11th August), applied by a Four Oaks barrel sprayer (Battle pattern), using a lance with a double Vermorel nozzle and adding saponin ($\frac{1}{2}$ oz. to 24 galls.) as an adhesive [ibid., xi, p. 375].

Wormald (H.). **A bacterial disease of Lilacs.**—*Gard. Chron.*, xcii, 2381, pp. 116–117, 4 figs. (2 on pp. 114–115), 1932.

Lilac shoots submitted to the writer for examination from Marlborough, Wiltshire, were found to be infected by a bacterial blight similar to that due to *Pseudomonas syringae* [*R.A.M.*, x, p. 96], inoculations with the rod-shaped bacterial organism isolated from which, on wounded shoots, produced the typical symptoms [which are briefly described] of the disease as it occurs in the United States and on the Continent. Full cultural tests of the organism to confirm its identity have not yet been carried out.

Tilford (P. E.). **Calla Lily root rot and its control.**—*Bimonthly Bull. Ohio Agric. Exper. Stat.* 157, pp. 138–140, 1 fig., 1932.

Considerable damage has been caused of recent years in Ohio by the root rot of Calla lilies [*Zantedeschia aethiopica*] due to *Phytophthora richardiae* [*R.A.M.*, ix, p. 787]. Affected plants show a yellowing and wilting of the foliage, discoloration and malformation of the blossoms, and rotting of the feeder roots, sometimes extending into the corms. The roots present a water-soaked appearance, and finally all that remains of them is the hollow tube of the epidermis; the texture of the rotted corms remains fairly dry and spongy. The fungus lives over from one crop to the next partly on the corms. Good control of the disease has been obtained by one hour's immersion of the corms before

planting either in 2 per cent. formaldehyde or mercuric chloride (1 oz. to $7\frac{1}{2}$ galls.), semesan being less effective.

BONGINI V[IRGINIA]. **Sur una malattia delle Cactacee.** [On a disease of Cactaceae.]—*La Difesa delle Piante*, ix, 3, pp. 34–39, 2 figs., 1932.

Cactus plants (*Cereus senilis, C. grusonianus*, and other species of *Cereus*) growing in glasshouses in Turin from seed sent from Mexico wilted when five or six months old and then died within three or four days. The affected stems showed the presence of a species of *Helminthosporium* with simple or bifurcated, nodulose, fuliginous, denticulate conidiophores which measured 90 to 170 by 7 to 13 $\mu$ and were paler at the top than at the base. The acrogenous conidia were usually single, but sometimes borne in twos or threes, and were smooth, pale (later dark) brown, obclavate-fusoid or cylindrical rounded at the ends or obpyriform, sometimes narrowed at the base, and with two to six, usually four, cells: they measured 30 to 65 by 10 to 13 $\mu$. The fungus is named *H. cactacearum* Bongini n. sp., and a Latin diagnosis is given. Inoculations of very young cactus plants gave positive results. The organism is probably a weak parasite attacking plants in a receptive condition with, perhaps, minute lesions in the epidermis.

Preventive measures should consist in sterilizing the soil by heat before setting the seed and spraying during the first year of growth with copper oxychloride.

SERVAZZI (O.). **Nota preliminare su una Phoma sp. n. riscontrata su Echeveria multicaulis purpurea.** [A preliminary note on a new species of *Phoma* found on *Echeveria multicaulis purpurea*.]—*La Difesa delle Piante*, ix, 3, pp. 39–42, 1 fig., 1932.

From the stem cortex of an *Echeveria multicaulis purpurea* plant which wilted, became defoliated, and died, the author isolated a species of *Phoma* with septate, branched hyphae 2·5 to 3·5 $\mu$ in diameter; simple, globose-ovoid or pyriform pycnidia averaging 350 $\mu$ broad; and cylindrical spores, measuring 8·3 to 8·5 by 3·3 to 3·4 $\mu$ and borne on very short, hyaline stalks. Elliptical pycnospores, measuring 6·6 by 3·2 to 3·3 $\mu$, were occasionally noted. Sclerotium-like aggregations were found in some of the diseased tissues, especially at the apex of the stem, where the disorganization was least advanced. Although isolated from dead material the fungus is considered to be most probably parasitic. Further investigations are in progress.

**Communications diverses sur le traitement hivernal des arbres fruitiers.** [Various communications on the winter treatment of fruit trees.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 3, pp. 70–118, 1 pl., 1932.

This is a collection of papers which were read at the March 1932 meeting of the Société de Pathologie Végétale et d'Entomologie Agricole de France, dealing with the winter treatment of fruit trees in various European countries, chiefly against insect pests,

but incidentally against fungal diseases. The individual papers are by C. T. Gimingham (England); L. Petri (Italy); N. Van Poeteren (Holland); H. Faes (Switzerland); P. H. Joëssel and F. Willaume (France). Most of the information of mycological interest contained in these papers has already been noticed in this *Review*.

**The orchard spray programme. Control of pests attacking Apples.**—*Tasmanian Journ. of Agric.*, N.S., iii, 3, pp. 110–119, 5 figs., 1932.

This is a detailed account of the results in 1932 of a comparative test of five different spray programmes carried out on a block of 15-year-old Sturmer Pippin apples. The materials tested, each in five applications involving a total of about 7 galls. liquid per tree, were weak dry lime-sulphur throughout, liquid lime-sulphur throughout, strong dry lime-sulphur throughout, iron sulphide excess lime-sulphur, and Bordeaux mixture followed by lime-sulphur and atomic sulphur. Arsenate of lead was added to the post-blossom sprays in every case. While all the schedules gave good commercial control of black spot [scab: *Venturia inaequalis*], the largest percentage of clean (93·5) and of marketable (98·7) fruit was given by the last-named programme, the cost of which is estimated at 9½*d.* per tree. It consisted of 6–4–40 Bordeaux mixture in the green tip stage, 1 in 20 liquid lime-sulphur in the pink stage, 1 in 40 ditto calyx spray, and 5 lb. atomic sulphur paste in 40 galls. water in the 4th and 5th sprays. Though apple mildew [*Podosphaera ? oxyacanthae*] was almost absent, experience has shown that this programme gives effective control of the disease [cf. *R.A.M.*, iii, p. 722; v, p. 675]. The best quality and most attractive fruit was obtained in the strong dry lime-sulphur series, but its high cost (11½*d.* per tree) and its lesser efficacy against scab (10·2 per cent. spotted fruit) militate against its general use. The cheapest schedule (7½*d.* per tree) was the complete liquid lime-sulphur one, but the higher percentage (12·3) of spotted fruit it produced renders its economic value questionable; the same also applies to the iron sulphide excess lime-sulphur spray, which cost 8½*d* per tree but gave 11·3 per cent. spotted fruit. The least effective against scab was the weak dry lime-sulphur schedule, which gave 15.1 per cent. spotted fruit, and cost 8*d.* per tree.

Although in several cases the spray mixtures were used at strengths often considered dangerous, very little leaf scorch or russeting was experienced, possibly owing to the addition of effective spreaders [*R.A.M.*, xi, p. 587].

DUTTON (W. C.). **Spray injury studies. I. Injuries from summer applications on Apples. II. Secondary effects of spray injury to Apple foliage.**—*Michigan Agric. Exper. Stat. Special Bulls.* 218, 68 pp., 2 col. pl., 19 figs. (1 col.); 219, 38 pp., 1 fig., 16 graphs, 1932.

Continuing his investigations on various aspects of apple scab [*Venturia inaequalis*] control in Michigan [*R.A.M.*, ix, p. 656],

the writer gives a fully tabulated account of recent observations on the injury caused by different methods of treatment.

Lime-sulphur, alone or in combination with lead arsenate, was found to cause definite and almost immediate damage characterized by the more or less extensive development of scorched leaf tissue. This form of injury is favoured by high temperature, though it may also occur under cooler conditions. Spray injury is further promoted by high humidity and slow drying at high or low temperatures, whereas low humidity and rapid drying are unfavourable to burning even at high temperatures. Generally speaking, high concentrations of lime-sulphur (e.g., $2\frac{1}{2}$ galls. in 100 galls. water) cause more injury than lower ones, while other factors tending to increase the damage are heavy applications and the presence of oil in the mixture.

Foliar distortion often arises from marginal injury by lime-sulphur on partly grown leaves. The stunting and blistering due to frost of the leaves appearing with the blossom buds may be increased by lime-sulphur, the excessive use of which with lead arsenate is further apt to retard development. Lime-sulphur injury frequently occurs through scab lesions on the leaves, killing the fungus but at the same time causing defoliation. Any form of sulphur on the foliage appears to increase sun scald.

Slightly less injury generally follows the use of dry lime-sulphur at concentrations equivalent to the liquid (4 lb. for 1 gall.) on Jonathans, while McIntosh is susceptible to russeting from this source. Free sulphur sprays, e.g., dry-mix, wettable sulphur, and flotation sulphur [ibid., xi, p. 788 and next abstract], and calcium monosulphide (cal-mo-sul) [ibid., viii, p. 387 *et passim*] appear to cause no damage to apple foliage.

Yellow leaf, a frequent sequel to treatment with lime-sulphur and acid lead arsenate, especially on the Wagener variety, is attributed to the formation of water-soluble arsenic on the combination of these materials. In the early stages this disturbance may be characterized by purple or reddish spots, but as a rule brown lesions of varying size develop, followed by yellowing of the leaves and soon afterwards by defoliation. This type of injury may be observed within a week or ten days after treatment or it may not occur until later. Much of the russeting of the fruit accompanying the use of lime-sulphur and lead arsenate probably arises from injury by water-soluble arsenic. Blossom-end injury is due to the soluble arsenic in the lead arsenate used with lime-sulphur and in other combinations.

Injury to apple leaves in the form of purple, later brown, spots, sometimes followed by yellowing and dropping, may be caused by Bordeaux mixture, while the russeting of the fruit consequent on early summer applications of this preparation is a limiting factor in its use in Michigan. Severe damage to both fruit and foliage has been caused by other copper sprays, such as basic copper sulphate and copper carbonate.

Discussing the secondary effects of spray injury to apple foliage, the writer finds that an excessive loss of fruit in the 'June drop' may result from unduly heavy or frequent treatments, high concentrations, heavy spraying from under the trees, and severe

lime-sulphur burn in the petal-fall or two weeks' applications. The production of blossom buds and consequently of fruit may be adversely affected by serious injury to the leaves, while the setting of the fruit may also be reduced by fungicidal treatments. The premature dropping of fruit just before harvest is often more extensive following considerable injury to the leaves, which may also reduce the size of the apples and prevent the full development of the red colouring. The measurement of annual rings also indicates an arrest in wood growth where the leaf area is diminished by spray injury.

BURKHOLDER (C. L.). **Dusting vs. spraying in Apples 1927–1931.**—*Indiana Agric. Exper. Stat. Bull.* 356, 28 pp., 1931. [Received November, 1932.]

The results [which are fully tabulated and discussed] of five seasons' experiments in Indiana on the relative merits of some standard fungicides and dusts in apple scab [*Venturia inaequalis*] control on the Jonathan, Stayman, Grimes, and Rome varieties showed that the dry treatments were less reliable throughout. When the rainfall was heavy in April and May (1929), even 14 applications of colloidal sulphur-arsenate (85–15) dust failed to suppress infection on Rome and Stayman, though it was effective for this purpose in dry seasons, e.g., 1931. Greatly improved scab control was secured by the application of either liquid or dry treatments during blossoming when this process was prolonged. The general appearance and vigour of the foliage was best on the dusted and flotation sulphur liquid plots [see above, p. 12, and preceding abstract]. In 1930 and 1931 dry lime sulphur-sulphur dust and flotation sulphur dust were equally effective with the colloidal preparation, while flotation sulphur paste and wettable powder gave as good scab control as the lime-sulphur spray. In 1931 severe yellowing and defoliation occurred on a plot treated with lime-sulphur and lead arsenate (4 lb. of each to 200 galls. water), the temperature at spraying time (14th July) being 85° F. Considerable foliage burn was observed in the plots dusted with flotation sulphur in July and August. Taking the results on Rome and Stayman as a whole, the injury on the dusted plots amounted to 13·8 per cent., compared with 4·9 per cent. on the sprayed ones. In conclusion the results of recent investigations on similar lines in other States are briefly summarized.

LOEWEL (E. L.). **Das Auftreten des Fusicladiums im Altländer Obstbaugebiet in seiner Abhängigkeit von Klima, Standort, Obstarten und-sorten und seine praktische Bekämpfung auf Grund zweijähriger Versuche des Obstbauversuchsringes.** [The occurrence of *Fusicladium* in the Alteland orchard region as conditioned by climate, habitat, fruit species and varieties, and its practical control on the basis of two years' experiments by the fruit-growing experimental circle.]—*Angew. Bot.*, xiv, 3, pp. 233–277; 4, pp. 283–333, 26 figs., 2 graphs, 1932.

A very detailed account, supplemented by numerous tables, is given of two years' experiments in the Alteland district of Hamburg in

the control of apple scab (*Fusicladium*) [*Venturia inaequalis*: *R.A.M.*, x, p. 672], the incidence of which in relation to climate, soil, and other local factors is fully discussed.

The best pre-blossom spray was found to be 2 per cent. Bordeaux mixture [see next abstract], which should be applied about the 20th to 25th April. With the aid of a special brand of tree-spraying carbolineum (Baumspritzmittel Avenarius) [*R.A.M.*, vi, p. 364], it is possible to combine the carbolineum treatment (indispensable under Alteland conditions) with the first pre-blossom anti-scab application in one working shift. The first post-blossom spray should be given immediately after the fall of the petals and withdrawal of the bees. The choice of fungicides must depend on the variety; the arsenic-containing copper fungicide nosprasit (1930) 0·5 to 0·75 per cent. or Sch. 987 (a more highly concentrated brand of the arsenic-free nosperit) at a strength of 0·3 to 0·5 per cent. are generally suitable and give excellent results. Bordeaux mixture at a concentration of 0·5 per cent. was superior to 0·25 per cent. but not very markedly so. Both concentrations were better than 2 per cent. lime-sulphur or 1 per cent. solbar. For varieties susceptible to scorching from copper preparations [a list of which is given], the 0·25 per cent. Bordeaux mixture is fairly safe and is more effective than lime-sulphur or solbar when scab is severe. The second post-blossom application, when the fruits are the size of a hazel-nut, should consist of 0·25 to 0·3 per cent. nosprasit. Owing to the great risk of late infections in the district under observation, fungicidal treatments in the middle of July and middle of August are essential. Apples intended for storage may be sprayed with copper-containing mixtures at fairly high concentrations, e.g., 0·5 per cent. Sch. 987 or Bordeaux mixture, while those for early picking should be treated with 2 per cent. lime-sulphur plus 1 per cent. lead arsenate paste.

The economic aspects of the treatment are considered and it is estimated that, under normal Alteland conditions, a net gain of M. 1321·30 per hect. (200 25-year-old trees) should accrue in comparison with a similar unsprayed area. Even 10 per cent. of this increase would be of immense value to the working fruit grower.

BRAUN (K.). **Tätigkeitsbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, Zweigstelle Stade, für die Zeit vom 1. April 1931 bis 31. März 1932.** [Report on the work of the Stade branch of the National Biological Institute for Agriculture and Forestry for the period from 1st April, 1931 to 31st March, 1932.]—Reprinted from *Altländer Zeit.*, Jork, 103, 111, 114, 116, 119, 123–4, 127, 9 pp., 1932.

The following items of phytopathological interest occur in this report. The best control of apple scab (*Fusicladium*) [*Venturia inaequalis*] in the Hamburg district of Germany during the period under review was given by Bordeaux mixture, although the standard concentration of 0·25 per cent. proved scarcely strong enough for the wet summer of 1931. Lime-sulphur (1 per cent.), cupulvit dust [ibid., xi, p. 767] (officially recommended by the German Plant Protection Service), Teller's copper-lime dust,

hercynia neutral (a copper-arsenic spray manufactured by Gebr. Borchers A.-G., Goslar-am-Harz), cutarsol, and nosprasit 'O' were less effective. The value of an application at the end of August was very noticeable in the case of Schur apples affected by late and storage scab [ibid., x, p. 800 and preceding abstract].

TURNER (H. A.). **Spore discharge of black spot (Venturia inaequalis).**—*Tasmanian Journ. of Agric.*, N.S., iii, 3, p. 128, 1932.

Investigations in 1931 of the seasonal discharge of the ascospores of the apple black spot [scab] fungus (*Venturia inaequalis*), which were made on the same lines as in the preceding year [*R.A.M.*, xi, p. 112], showed that there was a normal leaf fall of the trees in the preceding autumn, followed by an unusually wet winter and a spring rainfall below normal, and that only three ascospore discharges occurred during the whole season. This was in striking contrast to the 1930 season (which was marked by an early leaf fall, a wet winter, and a comparatively dry spring), during which the ascospores were discharged on sixteen separate occasions [loc. cit.].

HORNE (A. S.). **Biological work on fruit.**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1931*, pp. 272–289, 4 pl., 3 graphs, 1932.

Periodical exposures of plates in apple orchards were made from May, 1930, to May, 1931, in collaboration with Mr. Nitimargi [*R.A.M.*, xi, p. 51], in order further to investigate the distribution of fungi and bacteria in the air surrounding the trees. The [tabulated] results demonstrated that the principles governing the distribution of fungi or bacteria, considered as a class, also govern the distribution of individual species or groups of strains and are the same as those governing, say, the accuracy of dilution technique in estimating the numbers of organisms. Over 30 genera were recognized (in collaboration with Miss Carter) on the slides, those occurring most frequently being *Fusicladium*, *Cladosporium*, *Pleospora*, *Epicoccum*, *Alternaria*, *Sporotrichum*, *Botrytis*, *Fusarium*, and *Polyopeus*. The great majority of the fungi were found experimentally to be capable of invading the tissues of apples having, like Worcester Pearmain, a low acid content. Definite sources of infection found included *Cladosporium* on decaying apple leaves and diseased stalks of *Lolium italicum*, *E. granulatum* on the sclerotia and conidia of *Claviceps* (commonly parasitic on *L. italicum*), and *Trichothecium roseum* on decaying apple leaves.

Studies (with L. N. Seth) were continued of resistance in relation to the chemical composition of apples with special reference to the interaction between fungal growth and varied acid and sugar content, in which 14 different strains of *Diaporthe*, *Cytosporina*, and *Phomopsis* were tested. When the maximum growth rate in culture was obtained at zero acid or sugar, the resistance of the apple increased with increasing acid or sugar (e.g., some strains of *C. ludibunda*), but if the maximum growth rate is at some concentration other than zero resistance will first fall and then rise (some strains of *F. fructigenum*). Studies in collaboration with

L. N. Seth and S. N. Das Gupta showed that the order of attacking power of different strains and species of fungi may be expected to vary with the variety of apple if the varieties differ in acidity, and also with the age of the apples, as acidity diminishes with the age of the fruit. This was confirmed by experimental inoculations. In Bramley's Seedling, for example, in which acidity is relatively high, *C. ludibunda* (strain CE) was more active than *D. perniciosa* (strain DHF), but in Worcester Pearmain apples, in which acidity is relatively low, this order was reversed.

Other studies with L. N. Seth of induced changes in resistance confirmed the conclusion previously reached that apples injected with malic acid showed more resistance to fungal attack than uninjected apples, and also demonstrated that resistance was similarly increased when the apples were injected with sucrose. Three preliminary tests with potassium salts (chloride and malate) were made with Worcester Pearmain, using *D. perniciosa* (strain DHF), and in each test the radial advance recorded for the injected apples was less than that recorded for the uninjected ones.

To test whether ringing apple trees by lowering the nitrogen content increases resistance to attack, an experiment was carried out in which 20 apples each from ringed and unringed Newton Wonder trees were inoculated on one side with *C. ludibunda* and on the other with *D. perniciosa*, and stored at 18° to 20° C. for eight days. The apples from the ringed trees were found to have a lower nitrogen content than the others and a much lower total weight of decayed tissue, indicating a higher level of resistance.

In work on the effect of the stocks on the resistance of apples to storage rots Worcester Pearmain inoculated with *F. fructigenum* and Bramley's Seedling with *C. ludibunda* were tested, the stocks used being East Malling IV, V, VI, and X [ibid., iv, p. 354]. An analysis of the figures obtained for the mean radial advance of fungal attack per day showed that the stock does exert a definite influence on the resistance of the fruit of the scion.

Tests were also made of the effect on resistance of manuring with sulphate of ammonia, muriate of potash, and superphosphate, alone or in various combinations. The apples were all inoculated with *C. ludibunda* and stored at laboratory temperature. It was found that they fell into two groups, characterized, respectively, by high and low nitrogen content, the former group including only those from the sulphate of ammonia plots. All the sets with low nitrogen content were much more resistant than those with high, the most resistant of all coming from plots with muriate of potash; in these apples the amount of rotted tissue was almost negligible. In the high nitrogen group, the apples from the plot to which all three constituents were applied were much more resistant than where sulphate of ammonia was used singly or in combination with superphosphate.

KIDD (F.). **Influence of fungal invasion and mechanical injury upon the rate of carbon-dioxide production of Apples.**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1931*, pp. 111–114, 5 graphs, 1932.

Experiments [which are described and the results of which are

expressed graphically] were carried out in connexion with a biochemical study of senescence in stored apples to ascertain what effect an invading fungus causing an enlarging rot has upon the carbon dioxide production of sound tissue in the same fruit. They showed that when the carbon dioxide production of sound whole apples was compared with that of similar ones inoculated with *Penicillium* sp. and with that of apples killed by freezing at $-20°$ C. and then inoculated with the same fungus, there was, during the progress of rotting, an excess of carbon dioxide production which was not accounted for either by the mass of the rotted tissue or that of the sound tissue. It is attributed to increased production in the contact-zone between the spreading rot and the sound tissue. Whether the excess carbon dioxide production of this contact-surface arises from the tissue cells of the apple *in articulo mortis* or from the growing tips of the advancing fungal hyphae remains to be determined.

Tomkins (R. G.) & Trout (S. A.). **The prevention of decay of stored fruit by the use of volatile compounds.**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1931*, pp. 117–119, 1932.

After pointing out that any substance introduced for the purpose of preventing fungal rot into an atmosphere in which fruit is kept in storage must, if absorbed by the fruit, be non-injurious to health or else it must be removed by the metabolic processes taking place, the author states that acetaldehyde and ammonia satisfy these conditions and can, on a laboratory scale, prevent certain types of fungal rotting in certain fruits. Oranges and soft fruits stored in small concentrations of acetaldehyde remained more free from fungal attack than did similar samples stored in air.

The partial pressure of acetaldehyde required to prevent fungal attack is approximately that maintained by an aqueous solution of 1 in 200 to 500 parts by volume: the vapour concentration above such a solution held at 18° C. is about four-fifths the concentration of the solution. When sample lots of 20 wounded, inoculated oranges were stored in air and in acetaldehyde solutions of various concentrations, all those kept in air had rotted after only 7 days, whereas even after 30 days only 4 of these kept in 1 in 200 acetaldehyde had developed any rot.

Green mould of citrus (*Penicillium digitatum*) may be largely reduced by storing the fruit in air containing small quantities of ammonia [*R.A.M.*, xi, p. 366], the partial pressure of ammonia required being equal to that maintained by a solution of 25 c.c. of concentrated ammonia in 10 l. water; such a solution maintains a vapour concentration in air of 5 parts per 10,000 at 18°, 3 parts at 10°, and 2·5 parts at 3°. At higher concentrations the fruit is damaged.

When sample lots of 13 wounded oranges inoculated with *P. digitatum* were stored in air and in air containing various proportions of ammonia, the lot kept in air showed 11 rotted fruits after 7 days, whereas the lot stored in air containing 5 parts per 10,000 of ammonia showed only 6 rotted fruits after 28 days.

By dissociation ammonium bicarbonate crystals maintain a suffi-

cient ammonia pressure to prevent fungal growth. If oranges inoculated with *P. digitatum* are placed with or without wrappers in desiccators containing the crystals, rotting is largely prevented without injury to the fruit.

HOCKEY (J. F.) & WARD (R. W.). **Studies in Apple storage. I. The influence of fungicides on flavour and sugar content.**—*Scient. Agric.*, xii, 12, pp. 709–715, 1932.

The investigation briefly reported in this paper was made in continuation of the study initiated by De Long and Pickett of the effect of fungicidal sprays on the composition of apple fruit [*R.A.M.*, x, p. 674], and was carried out on apples of the 1930 crop from variously treated trees of the McIntosh, Ribston, Stark, and Northern Spy varieties in Nova Scotia. The results indicated that Bordeaux mixture sprays, under the climatic conditions of the season, tended to increase the sucrose and total sugar of the apples in all the varieties tested, while aluminium sulphate-lime sulphur sprays had the same effect in only two of the four varieties tested. Spraying with lime-sulphur alone tended to depress the sugar content in two of the varieties. Palatability tests showed that the flavour of the fruit is improved by a higher sugar content.

TILLER (L. W.). **Influence of carbon dioxide on internal breakdown in the Sturmer.**—*New Zealand Journ. of Sci. & Techn.*, xiv, 1, pp. 20–22, 1 fig., 1932.

Tests were initiated in the summer of 1931, with funds placed at the disposal of the Cawthron Institute by the Department of Scientific and Industrial Research, to determine the influence of carbon dioxide in the storage atmosphere on the incidence of internal breakdown in Sturmer apples [cf. *R.A.M.*, iv, p. 549; ix, p. 462]. The experiments were carried out at a temperature of 35° F. on fruit that had already been in storage at 38° for 11½ weeks.

The concentrations of carbon dioxide tested were 0·4, 5, and 10 per cent., while the oxygen content ranged from 18 to 20 per cent. For the lowest concentration pure air was used, freed from carbon dioxide by passage through an aspirator containing pumice saturated with caustic potash solution. The other cylinders contained slightly less than the desired concentrations of carbon dioxide, the rate of flow of gas being so adjusted by means of a reducing-valve that the apples evolved sufficient carbon dioxide to bring the total percentage to the requisite figure. Before introduction into the containers all the gases were brought to the same relative humidity. The fruit was held under these conditions from 3rd July till 21st December and examined four days later.

The presence of carbon dioxide was found to have caused a definite increase in the amount of internal breakdown, 7 per cent. of the fruit at the 10 per cent. concentration showing severe symptoms and 44 per cent. slight, the corresponding figures at 5 per cent. being 3 and 24, and at 0·4 per cent. 0 and 8, respectively. It is evident, therefore, that carbon dioxide concentrations even well below the danger limit for the development of brown heart [ibid.,

iv, p. 224; ix, p. 115; x, p. 115] are unsafe for the prolonged storage of apples at low temperatures.

THOMAS (P. H.) & RAPHAEL (T. D.). **Internal cork in Apples associated with malformed wood growths.**—*Tasmanian Journ. of Agric.*, N.S., iii, 2, pp. 69–73, 4 figs., 1932.

During the winter of 1931, apples lying at the foot of an 18-year-old Sturmer Pippin tree long affected with crinkle and cork [*R.A.M.*, ix, p. 322] were found to be very badly malformed by the latter condition, which had attacked the young fruits and produced one of the worst cases of the disease ever observed in Tasmania.

The tips of the branches and spurs which had borne the affected apples were swollen and malformed. The fully matured fruits were superficially knobby and distorted, with sunken areas darker than the surrounding skin. The flesh showed considerable dark brown, irregular, necrotic areas, most prevalent round the core and seldom extending to the skin; the core and seeds were frequently only partially developed. The current wood growths appeared to be normal up to 1 or 2 in. of the tips, where they generally bore pubescent, gall-like swellings. The buds were unaffected, but the internodes near the tip were very short, the resulting crowding of the buds giving a characteristic effect. The bark was distended and sappy.

Sections of the swollen wood showed signs of cell rupture throughout, extending especially transversely along the medullary rays. Large portions of the parenchyma had failed to lignify properly, and brown areas (apparently consisting of dead cells) like those typical of bitter pit were present in the wood.

The tree, which was normally developed and growing well and had always been pruned by the short spurring or 'pole' method, was in light soil overlying yellow, friable clay. It had long been affected by this disorder, from which the surrounding trees suffered less severely.

Further investigations are in progress.

TETLEY (URSULA). **The development and cytology of the leaves of healthy and 'silvered' Victoria Plum trees.**—*Ann. of Botany*, xlvi, 183, pp. 633–652, 2 pl., 3 figs., 1932.

A full account is given of the author's comparative cytological study of the development of normal Victoria plum leaves and those which have become silvered as a result of attack by *Stereum purpureum* [*R.A.M.*, xi, p. 59] on the tree.

Observations were made on three classes of mature silvered leaves, (1) those (much smaller than healthy leaves) on trees in a very advanced stage of the disease: these became yellow and then brown very early, and fell off about July; (2) those which though deformed were more nearly normal in size: these had become yellow and brown by 2nd July, and fell early in September; (3) leaves approximately normal in size and shape but heavily silvered. These were still on the tree on 8th October, but yellowing had set in towards the end of September, followed by the appearance of small, isolated brown patches.

The cells of the mesophyll of the leaves in class (1) showed rapid nuclear and cytoplasmic degeneration. Numerous palisade cells were separated from the epidermal cells. In one leaf of class (2) the cell contents showed granular deposits completely filling many of the vacuoles, and the chloroplasts were small and contained no starch grains. In another leaf of the same class, in which the disease was less advanced, no granular deposits were present, but there was an excessive starch accumulation. A typical grey-green leaf of the third class showed much of the palisade free from the epidermis. In any one section the condition of the cell contents is extraordinarily varied, this being characteristic of all the silvered leaves which had remained on the tree until the autumn. Cells in which the nuclei became densely stained and in which the chloroplasts had disappeared were present together with cells containing chloroplasts with starch grains and normal nuclei. Among these were other cells with chloroplasts devoid of starch grains and with small, heavily staining nuclei.

All these leaves were heavily silvered. Those only moderately affected seldom show any peculiar cytological features in their mature stages, and are definitely distinguishable from normal leaves only by the separation (much less pronounced than in heavily silvered leaves) of the palisade tissue from the epidermis, and sometimes by a tendency to an undue accumulation of starch in the mesophyll.

The meristematic changes in silvered leaves indicate a retardation of the normal rate of cell division of the mesophyll, some substance probably being present in diseased leaves which partially inhibits nuclear division. In the mature tissue the nuclei show a range of behaviour which indicates that diseased leaves pass through their senescent phases rapidly and prematurely.

Smolák's observations (*Annals of Applied Biology*, ii, p. 138, 1915) that the chloroplasts of silvered leaves become corroded before they disintegrate, and that the spongy mesophyll cells of silvered leaves are longer than those of normal leaves, were not confirmed by those of the author.

The separation between the palisade and the epidermis in silvered leaves results from an inhibition of cell division in the palisade during the meristematic stage.

A bibliography of 14 titles is appended.

HUTCHINS (L. M.). **Peach mosaic—a new virus disease.**—*Science*, N.S., lxxvi, 1962, p. 123, 1932.

Most of 56 nursery peach trees grafted or budded in July, 1931, with Texas material showing symptoms suggestive of mosaic developed similar symptoms early in 1932, including shortening of the internodes, profuse growth of the leaf axil buds, and striking mosaic patterns on the leaves, which were often small, narrow, crinkled, and irregular in outline [cf. *R.A.M.*, xi, p. 521]. These symptoms appeared not only on the new growth from the aerial part of the trees but also on newly developed root suckers. The disease was communicated by inoculum from either the roots or shoots of the suspected trees. It is therefore evidently systemic.

This is believed to be the first record of an infectious mosaic on the peach. So far the distribution of the disease is believed to be limited to two orchards, and hence a thorough survey and prompt eradication of infected trees would seem to be practicable.

SMITH (F. E. V.). **Panama disease of Bananas in Jamaica.**—*Jamaica Dept. of Sci. & Agric., Microbiol. Bull.* 1, 22 pp., 1 map, 1932.

Though very strong evidence exists that Panama disease (*Fusarium cubense*) [*F. oxysporum cubense*] was present in certain parts of Jamaica as early as 1902, and it may even be indigenous, the disease was first definitely reported in 1912, when an outbreak occurred in the parish of Portland. Almost immediately after, it appeared in two other localities so remote from the first that any connexion between the outbreaks was impossible.

Owing to drastic quarantine regulations [*R.A.M.*, x, p. 43] the disease at first progressed very slowly, but from 1918 onwards, owing partly to the failure of growers to co-operate in carrying out the regulations, it steadily spread.

The original quarantine area of 4 sq. chains round each diseased plant or a corresponding area for a diseased patch has been maintained for all initial outbreaks (except in the parish of Portland where eradication has been abandoned) [ibid., xi, p. 62], though for subsequent ones the nine-root system is allowed at the discretion of the Director of Agriculture. The one-root system [ibid., xi, p. 625] is most dangerous in any land which is to be maintained in bananas, and is permitted only when the property is officially gazetted as infected and when adjacent lands are not endangered. The quarantine methods adopted have been successful in restricting the spread of the disease; 1929 was actually a record crop year though the disease had then been present at least seventeen years.

Under Jamaica conditions, Panama disease spreads very rapidly on irrigated lands [cf. ibid., x, p. 11], in some instances more rapidly than elsewhere. Soil alkalinity is no deterrent. Many of the worst outbreaks have occurred on the best lands, often soon after they have been brought into cultivation, while some poorer lands have not been rapidly infected. The better the cultivations and the richer the soil, the more rapid is the spread of the disease. In a large-scale experiment on the effect of high cultivation and first-class drainage, in which heavily infected but otherwise excellent land was replanted, over 50 per cent. of the plants became attacked in twelve months, only about 200 stems being harvested from some seven acres. Initial outbreaks have frequently followed from flooding consequent upon extending the plantations right up to the edge of the rivers.

By the end of 1931, 249,274 diseased plants had been recorded [since 1912] from parishes other than Portland, while in Portland itself 155,398 diseased plants were recorded up to the end of 1929 when recording ceased. Taking the island as a whole, the incidence of the disease increases annually by about 50 per cent., with very much greater increases locally when conditions are exceptionally favourable. The total loss of land in the last twenty

years amounts at a liberal estimate to not more than 15,660 acres out of 81,848 acres, but as the latter, official, figure for the total area cultivated is a very conservative estimate, the real proportion of land destroyed probably does not exceed one-tenth of the total under cultivation in the period. In parishes other than Portland, 6,660 out of 72,337 acres have been abandoned or destroyed, the probable loss (again allowing for the conservative official estimate of the total acreage) amounting to one-fifteenth or less of the available land. Estimating the annual rate of increase of the disease at 50 per cent., and allowing for the abandonment of numerous riverside plantations, it is unlikely that the output will be seriously affected before 1936.

The solution of the banana wilt problem in Jamaica depends entirely on the rapid development of a marketable immune variety. In this connexion, the seedlings raised by Mr. Sutherland [ibid., xi, p. 625] are of the highest promise. Every effort should be made also to develop secondary crops, especially citrus.

Becze (G. v.). **Beiträge zu den während des Transportes und während der Reifung auftretenden Fäulniskrankheiten der Bananen.** [Contributions to the study of the Banana rots occurring during transport and ripening.]—*Zentralbl. für Bakt.*, Ab. 2, lxxxvi, 16–18, pp. 381–399, 7 figs., 1932.

During the period from July to October, 1931, the writer inspected consignments of bananas arriving at Hamburg from the Cameroons, Fernando Po, the Canary Islands French Guinea, Brazil, and the West Indies. The fruit consisted mainly of Gros Michel (*Musa sapientum*) with some lots of *M. cavendishii* from the Canaries. The losses occurring from decay in storage at the port amounted in some consignments to between 20 and 25 per cent.

The rots are divided into seven groups according to the parts of the bunch affected. Infection and the factors in its causation are briefly discussed under the headings of spores, wounds, air and humidity, and temperature. The fungi found on the diseased organs were *Gloeosporium musarum*, *Thielaviopsis* [*Ceratostomella*] *paradoxa*, *Oidium lactis* f. *musarum* n. f. from Brazil and the Canaries, *Fusarium semitectum* Berk. et Rav., var. *majus* Wr. (the most prevalent after *G. musarum*), *F. aquaeductum* Lagh. non Radlk. et Rabenh. [see below, p. 58], *Gibberella saubinetii* from Brazil and the Canaries, *Verticillium* spp., including *V. albo-atrum* and *V.* (?) *candelabrum*, the latter on *M. cavendishii* from the Canaries, *Helminthosporium torulosum* [*R.A.M.*, xi, p. 464], *Cercospora kopkei* [ibid., xi, p. 205] from Jamaica and Brazil, *C. longipes* [ibid., ix, p. 808] from Brazil, *H. sacchari*, *Colletotrichum falcatum* on a few plants from Brazil, *Macrophoma musae*, *Vermicularia* [*Colletotrichum*] *dematium*, *Botryodiplodia theobromae*, *Cephalothecium* [*Trichothecium*] *roseum*, *Pestalozzia leprogena*, *Albugo* sp., *Alternaria* sp., and *Aspergillus wentii*, while secondary infections were caused by *Cladosporium herbarum*, *Penicillium crustaceum*, *Mucor mucedo*, *Rhizopus nigricans*, *Saccharomyces* sp., *Torula variabilis* and *T.* spp.

*O. lactis* f. *musarum* was highly destructive to the fruits, entire bunches of which decayed rapidly as a result of infection and become covered in moist air with a white felt of radiating hyphae. Stems or fruits attacked in the green or semi-ripe stage soon became moist and soft. The spore (oidia) dimensions were 8 to 20 by 4 to 6 $\mu$.

YOUNG (W. J.), BAGSTER (L. S.), HICKS (E. W.), & HUELIN (F. E.). **The ripening and transport of Bananas in Australia.**—*Australia Council Sci. & Indus. Res. Bull.* 64, 52 pp., 4 graphs, 1932.

In this bulletin a full report is given of the transport and ripening of bananas as practised in Australia, with details of experimental work and recommendations of improved methods. In a section on the diseases of the fruit during ripening and transport observations are made on black end [*R.A.M.*, viii, p. 256; x, p. 44] associated with *Verticillium* sp., *Gloeosporium musarum*, and *Fusarium* spp.; the more serious stem-end rot which usually begins in transit when the fruit is hard and green, the pulp under the affected skin becoming soft, watery and evil-smelling; anthracnose (*G. musarum*: ibid., v, p. 377]; and squirter [ibid., xi, p. 794].

SIMMONDS (J. H.). **Powdery spot and fruit scab of the Passion Vine.**—*Queensland Agric. Journ.*, xxxviii, 2, pp. 143–152, 7 figs., 1 graph, 1932.

The powdery spot and fruit scab of passion fruit (*Passiflora edulis*) caused by an undetermined *Cladosporium* [*R.A.M.*, x, p. 394] in Queensland affects only the younger terminal shoots and fruit, first appearing on the leaves as a small, circular, translucent spot having a narrow, faintly brown border and attaining up to 6 mm. in diameter. Subsequently the spot becomes grey and powdery owing to fungal fructification. Similar spots may occur on the sepals, and brown sunken areas, generally partly filled with a powdery mass of spores, on the younger parts of the runners, petioles, and tendrils. On the fruit minute, light brown, slightly depressed, circular dots appear and gradually reach 2 to 3 mm. in diameter, the margin at the same time becoming raised and producing a crater-like effect. At this stage the outer layers of the rind constitute a thin shell covering a small cavity due to disintegration of the parenchyma, and under favourable climatic conditions this covering may bear a thick dusky coat of spores resembling that on the leaf lesions. Later, vertical growth is stimulated below the excavation, so that the corky lining becomes raised into a dome-shaped or fissured scab 1 to 3 mm. high. By this time, virtually all trace of the fungal origin of the condition has disappeared.

The sclerenchymatous cells adjacent to the invaded region degenerate and lose much of their thickness, until they become scarcely distinct from the parenchyma. Before this destruction has progressed more than a millimetre or two inwards, the cells below the excavation take on a meristematic function, and

eventually a definite phellogen appears. From this a few corky layers are produced on the outside, and from the inner side definite radial rows are formed of tissue consisting largely of sclerenchymatous elements, the continuous formation of this latter tissue rupturing the covering veil and producing the scabby excrescence. Fruit infection usually occurs during the early stages of growth, but the raised scab may not reach its full dimensions until after the fruit has attained its full diameter. Slight deformity of the mature fruit may accompany the presence of one or more scabs owing to the growth of the rind tissue round the point of infection becoming restricted.

Infection is quickly followed by defoliation of the younger terminal leaves, and during an epidemic the runners may be spotted or girdled up to 12 in. back, the shoots wilting and dying back in consequence. Powdery spot is most serious on vines up to two years of age.

When young leaves were inoculated in the laboratory in moist conditions between 15° and 25° C. with the *Cladosporium* associated with the disease typical lesions were produced, and the fungus was reisolated.

Two types of spores were found (sometimes in the same chain) both in nature and in culture. The more common form was oval or elliptical, continuous, and averaged 6·1 by 3·9 $\mu$, while the other was more elongated (average 13·7 by 4·2 $\mu$), almost cylindrical, continuous or uniseptate. The same disease was also found on *P. herbertiana*, the average spore measurements of the two types on this host being 6·3 by 3·7 $\mu$ and 11·6 by 4 $\mu$, respectively. A similar powdery leaf spot without any fruit scab was noted on *P. alba*, but the cultural characters of the *Cladosporium* associated with the condition suggested that it was distinct from that found on the other two hosts, and the average spore measurements were 6·5 by 4 $\mu$ and 11 by 4·3 $\mu$, respectively.

Powdery spot does not usually become prevalent until April, infection reaching its peak in June and July. The foliage symptoms become less abundant as the weather grows warmer, but the fruit may exhibit scabs (the result of earlier infection) in November. Occasionally an early setting of summer crop fruit may also become scabbed. The maximum growth temperature for the *Cladosporium* is 28°, while the optimum is from 20° to 22°. The restricted distribution of powdery spot, which has only been found in two widely separated districts, is evidently due to the cool, moist conditions required by the fungus.

The control measures recommended are similar to those advised against the brown spot due to *Macrosporium* sp. [loc. cit.], except that the vines must be sprayed with Bordeaux mixture from April to August. Special attention should be paid to spraying the young foliage and fruit, vines up to 2 years of age requiring most care.

CUNNINGHAM (G. H.). **Orchard sprays in New Zealand. III. The copper series.**—*New Zealand Journ. of Agric.*, xlv, 1, pp. 33–39; 2, pp. 70–77, 1932.

In this, the third communication of this series [*R.A.M.*, xi,

p. 655], the author deals with the various cupric fungicides in use in New Zealand for the control of orchard and vineyard diseases, the greatest space being given to the preparation and application of Bordeaux mixture, which is considered to be the most important. The other sprays briefly discussed are Burgundy mixture, cuprammonium spray, Cheshunt compound, copper acetate, colloidal copper hydroxide, and copper sulphate solution. Copper-lime dusts have proved worthless in New Zealand trials, besides frequently causing severe injury to the plants and costing from three to five times as much as the comparable Bordeaux sprays. A separate section discusses the effects of the sprays upon the parasites and the hosts, and the whole ends with some recommendations for the use of the sprays.

NEWHALL (A. G.) & CHUPP (C.). **Soil treatments for the control of diseases in the greenhouse and the seedbed.**—*Cornell Agric. Exper. Stat. Extens. Bull.* 217, 59 pp., 20 figs., 7 diags., 1931. [Received September, 1932.]

Directions are given for soil sterilization against greenhouse and seed-bed diseases in New York State by various methods, with notes on installation and costs. The methods include steam sterilization by 'buried tiles' (a series of trenches 13 to 16 in. deep and 18 in. apart, in which ordinary clay drain tiles (pipes) are closely laid end to end, fed by one or two 'header' pipes delivering steam from a 100 h.p. boiler, thereby raising the soil temperature to 160° F. in three to six hours); the buried perforated pipe (a modification of the former); the inverted pan [*R.A.M.*, viii, p. 276]; dry heat (surface burning and English ovens); boiling water (for pots only); various chemical treatments, including formaldehyde, acetic acid, lime, carbon bisulphide, sulphur and its compounds, copper and mercury compounds; and electric light (Mazda lamps of 200-watt power suspended 2 ft. above the seedlings).

SMITH (K. M.). **Filtration of plant viruses.**—*Nature*, cxxx, 3276, p. 243, 1932.

During the past nine months the writer has been filtering the two potato mosaic viruses, $x$ and $y$, by means of W. T. Elford's collodion membrane technique [*R.A.M.*, xi, p. 735]. Preliminary experiments showed that, while the $x$ virus was filterable through an $L_3$ and occasionally, an $L_5$, Pasteur-Chamberland candle, the $y$ virus would not pass the $L_1$ size. Similar tests with collodion membranes indicated that both viruses would pass a membrane of the approximate pore size 0·35 $\mu$, while both are held back at 0·15 $\mu$. The incapacity of the $y$ virus to pass the $L_1$ candle is attributed to the adsorption of the former by the latter, rather than to the porosity of the candle or the size of the virus particle. It has been found that if the virus complex, $x+y$, is passed through a kieselguhr bed in a Buchner funnel, the filtrate invariably contains a 'pure culture' of the former virus, the latter being completely adsorbed by the kieselguhr; this offers a simple means of separating out a complex of the two viruses.

MATSUMOTO (T.) & SOMAZAWA (K.). **Immunological studies of mosaic diseases. II. Distribution of antigenic substance of Tobacco mosaic in different parts of host plants.**—*Journ. Soc. Trop. Agric.*, Formosa, iv, pp. 161–168, 1932. [Japanese summary.]

It has been shown that the leaf extract of tobacco mosaic can stimulate the production of specific precipitating antibodies when injected into a rabbit [*R.A.M.*, x, p. 563]. Further studies were made to determine whether such antigens occur in the parts of infected plants showing no recognizable mosaic symptoms, and how they are formed and spread.

All parts of the diseased plants were found to contain the specific antigen, even when there were no symptoms. Root extracts caused the production of specific antibodies when injected into rabbits.

The concentration of the antigenic substance was measured in the different parts of infected plants. Antigenic activity was found to be highest in dried leaves and about equal in the expressed juices of fresh leaves and of fresh and dried roots. In stems, especially dried ones, the antigenic concentration was very low, notwithstanding the fact that heat desiccation produced no injurious effect on antigenic activity.

Tests carried out to ascertain whether the formation of the antigen takes place parallel with the multiplication of the infective agent showed that no noticeable reaction followed the use of juices prepared from portions of inoculated plants until four or more days after inoculation. The antigen was distinctly recognizable in the apical and subterranean portions of the plants before mosaic symptoms appeared. In a series of tests to determine the distribution of the antigen in various parts of the plants, it was found to appear in the portions above the point of inoculation four days after the operation, the underground parts developing it later.

It is inferred that the antigenic reaction is actually due to the infective agent and not to modifications of the host protein [ibid., xi, p. 406].

PLANTENGA (MARIA H. J.). **Pathologische veranderingen in het phloem.** [Pathological alterations in the phloem.]—Thesis, University of Utrecht (Hollandia- Drukkerij, Baarn), 108 pp., 26 figs., 1932. [English summary.]

In connexion with a study of the phloem necrosis of coffee in Surinam [*R.A.M.*, xi, p. 637], the writer's attention was drawn to the need for further investigations on this condition in a number of other plants. In the present paper a comprehensive account is given of her recent anatomical researches in Holland on the pathological changes induced by various agencies in the phloem of beech, lime (*Tilia europaea*), *Phlox suffruticosa*, *Vitis gongyloides*, tomato, and coffee (*Coffea arabica*).

The swelling of the cell walls accompanying phloem necrosis occurs in beech, lime, *P. suffruticosa*, coffee, and *V. gongyloides*

after ringing or other forms of wounding; as a sequel to fungous infection in beech, lime, and tomato; after the injection of chemical solutions (hydrochloric acid, oxalic acid, or sodium hydroxide) in beech and lime [ibid., ix, p. 81]; and following the injection of the metabolic products of the canker-forming fungi *Nectria galligena* var. *major* [ibid., vii, p. 677] or *Myxosporium carneum* in beech. The swelling of the cell walls begins simultaneously in all parts of the wall in beech, lime, tomato, and coffee, while in *P. suffruticosa* and *V. gongyloides* the corners of the cells first become involved. The pathological alterations are more marked above than below a wound in beech and *V. gongyloides,* whereas in *P. suffruticosa* and coffee the reverse is the case. In beech wounding causes a more extensive swelling of the cell walls than fungous infection, while in lime the results are identical in both.

Beech branches were inoculated with pure cultures of *Stereum hirsutum, S. rugosum* [ibid., x, p. 70], *Asterosporium hoffmanni, Pleurotus ostreatus, N. galligena, Pholiota aurivella* [ibid., vii, p. 292], *Polyporus squamosus* [ibid., ix, p. 81], and *Phlebia aurantiaca*, all of which produced more or less pronounced anatomical modifications. The fungi inoculated into lime branches were *Pleurotus ostreatus, Polyporus squamosus, N. cinnabarina, Collybia velutipes* [ibid., x, p. 632], and *Pyrenochaeta* sp., of which the last three produced the most striking necrotic symptoms, comparable to those consequent on wounding. The intraxylar phloem and the phloem parenchyma of tomato stems inoculated with *Diplodina* [*Didymella*] *lycopersici* [ibid., xi, p. 809] underwent far-reaching changes, including swelling and yellowish-brown discoloration of the cells, which were filled with gum; the extraxylar parenchyma and cambial cells were also affected to a slighter extent. This type of phloem necrosis presents a close analogy with that occurring in potato plants suffering from leaf roll [ibid., xi, p. 121]. The wood vessels of *Phlox suffruticosa* inoculated with *Phoma phlogis* Roum. were found to contain mycelium and gum, but no modifications of the phloem or cortical parenchyma were apparent.

The swelling of the cell walls associated with fungous infection in beech was observed to be more prominent in the summer than in winter, whereas with wounding the opposite was the case. Gummosis is more active in summer than in winter both in beech and lime, and in beech, lime, tomato, and coffee the swollen cell walls become infiltrated with gum after the cell-contents have developed gummosis. Lignification of the swollen cells was found to occur in beech and *P. suffruticosa.* In lime and beech phloem necrosis is more severe in the younger parts, while in *V. gongyloides,* tomato, and coffee the older portions are chiefly affected. After three to five months phloem necrosis only extends for a few inches above and below a wound or site of infection or injection in beech and lime; the site of infection in tomato; and a wound in coffee. Wounded or infected branches of lime form a great deal more parenchymatous traumatic tissue between the diseased phloem and the cambium than those of beech.

A bibliography of 75 titles is appended.

MINKEVIČIUS (A.). **Untersuchungen über den Einfluss der Narkose auf die Pilzempfänglichkeit der Pflanzen.** [Investigations on the influence of narcosis on the susceptibility of plants to fungous infection.]—*Phytopath. Zeitschr.*, v, 2, pp. 99–152, 3 figs., 11 graphs, 1932.

Cauliflower (Le Cerf variety) and Klosterfrauen bean (*Phaseolus vulgaris*) seedlings were grown in pots in frames made of eterniet (a mixture of cement and asbestos) [*R.A.M.*, x, p. 598] and exposed to fungous infection under the influence of narcotics (chloroform, ethyl ether, and ethyl alcohol) for periods of 10 minutes to 84 hours at varying doses with a temperature range of 12° to 24° C. [cf. ibid., x, p. 479]. The fungi used for artificial inoculation were *Alternaria brassicae* for the cauliflowers and *Uromyces appendiculatus* for the beans. The atmospheric humidity in the frames fluctuated between 75 and 95 per cent., and each frame was lighted by a 1,000-Watt Osram-Nitra lamp (extinguished during the night in the longer tests). Sixty plants were used for each experiment (ten in each of six frames, of which three served as controls). The inoculations were carried out either shortly before or immediately after narcotization with spore suspensions in tap water, to which 0·1 per cent. gelatine was added to facilitate adhesion to the cauliflower leaves. Details are given of the construction of the incubation chambers in which the plants were placed after treatment, and also of the statistical methods used in calculating the degrees of infection obtained.

The results of the experiments [which are fully discussed and tabulated] showed that the susceptibility of the cauliflower plants to *A. brassicae* was not appreciably affected by narcotization with chloroform (applied in doses ranging from 42 to 45 c.c. per cu. m. of air for 84 hours to 95 to 98 c.c. for 10 minutes), except for a marked increase of infection induced by prolonged exposure (48 hours) to a relatively strong concentration (65 c.c.). The growth of the plants was distinctly accelerated by treatment with chloroform. Ethyl ether (680 to 710 c.c. per cu. m. for 48 and 725 to 760 c.c. for 12 hours) and ethyl alcohol (16 to 20 c.c. for 84 and 30 to 33 c.c. for 12 hours) also failed to influence the reaction of the plants to the fungus. Ether slightly stimulated plant growth, while alcohol was indifferent in this respect also. On the other hand, the susceptibility of the bean plants to *U. appendiculatus* decreased under the influence of protracted exposure (12 hours or more) to chloroform, applied in doses of 62 to 66 c.c. per cu. m. The decrease in the incidence of infection was correlated with a check to the growth of the plants. Similar results were obtained with ether (610 to 645 c.c. for 12 and 715 to 740 c.c. for 2 hours) and alcohol (27 to 29 c.c. for 12 and 33 to 36 c.c. for 2 hours).

It is apparent from these results that the influence of narcotization differs with the two fungi. It is concluded that whereas the only case of increased infection on cauliflower plants (those exposed for 48 hours to the highest concentration of chloroform used for this length of exposure) was evidently due to the effect of narcotization on the spores of *A. brassicae*, the differences in susceptibility of the treated and untreated bean seedlings to *U. appendiculatus* depend

exclusively on the influence of narcosis on the plants and not on the fungus.

TOMKINS (R. G.). **The action of certain volatile substances and gases on the growth of mould fungi.**—*Proc. Roy. Soc. London*, Ser. B., cxi, B771, pp. 210–226, 11 graphs, 1932.

This is a full account of experiments to test the action of certain volatile substances and gases on the growth in pure culture of *Trichoderma lignorum* and various other fungi, including *Rhizopus nigricans*, *Thielaviopsis* [*Ceratostomella*] *paradoxa*, *Gloeosporium musarum*, and *Botrytis cinerea*, a preliminary report on some of which has already been noticed [*R.A.M.*, xi, p. 63]. It was shown that germination and the initial growth of *T. lignorum* were very slightly delayed in the presence of acetone, but much more in that of acetaldehyde, this effect being in part due to differences in the action of the substances on the time required for germination, i.e., the latent period of germination. The rate of increase in the size of the colonies remained constant at the various concentrations of acetone, but in the case of acetaldehyde it increased as the colony grew larger. Transference from pure air to the presence of acetone resulted in a rapid reduction of the growth rate to a value determined by the concentration of the substance, which subsequently remained constant, independently of the size of the colony before transfer. When transferred to the presence of acetaldehyde, the rate of growth was immediately decreased or was even stopped; it did not, however, remain at the initial low value, but increased with the time of exposure up to a certain value which then remained constant, the whole process of initial reduction and subsequent recovery of growth depending on the size of the colony before transference. The concentration of acetaldehyde needed to inhibit germination was less than that required to inhibit growth.

Chloroform, ether, ethyl alcohol, formaldehyde, and amyl formate retarded the growth of *T. lignorum* in a manner similar to acetone; propionaldehyde and butyraldehyde, on the other hand, acted like acetaldehyde. The concentration in the atmosphere of the volatile substances needed to inhibit germination and growth varied with the temperature, being higher at the higher than at the lower temperatures tested.

Sulphur dioxide retarded the growth in a manner similar to acetone, in that it did not delay germination compared with that in the air, and the rate of growth did not increase as the colony grew in size. At first, after transference to its presence, the rate of radial spread decreased, owing, it is believed, to the slowness with which the sulphur dioxide absorbed by the agar comes into equilibrium with that in the atmosphere; this view is supported by the differences in the rate of decrease which were observed when the gas was renewed at varying intervals of time. On the other hand, hydrogen cyanide and hydrogen sulphide acted like acetaldehyde in that the latent period of germination was prolonged, the growth rates following germination were much reduced, but increased as the colonies grew, and the concentration required to inhibit growth was greater than that needed to inhibit germination. On transference from air to their presence, the growth rates

were at first reduced, and then increased to a constant value. The action of ammonia differed from that of the substances above mentioned in that it prolonged the latent period of germination very considerably, and the same concentration was needed to inhibit germination as to inhibit growth.

The reaction of the other fungi tested to the various volatile substances and gases was very similar to that of *T. lignorum*.

EYRE (J. C.). **Cultural studies on the Aspergilli, with special reference to lipase production of strains isolated from stored Copra and Cacao.**—*Ann. of Appl. Biol.*, xix, 3, pp. 351–369, 1932.

The experiments briefly reported in this paper had for their purpose to determine the production in pure culture of lipase by nine (named) species of *Aspergillus* and also by *Mucor racemosus*, *Syncephalastrum cinereum*, and a blue-green species of *Penicillium*, all of which were isolated from stored copra and cacao beans [cf. *R.A.M.*, xi, pp. 175, 285]. The results [presented in tabular form] showed that all the species and strains of *Aspergillus* produced lipase in their mycelium, and diffused it into the liquid nutrient medium, and that they fall, on the base of the amount of the enzyme excreted into the medium, into two classes, *A. flavus* (a light-coloured strain), *A. tamarii*, *A. sydowi*, and *A. ochraceus* producing considerably more than the others (which included a dark strain of *A. flavus*). While the lipolytic activity of the dried mycelial mats and of the medium was materially the same at the end of two weeks as of four weeks of growth, at the end of eight weeks determinations showed an increase in the activity of the medium and a decrease in that of the dried mats; this suggests that the increased lipolytic activity of the medium is due to autolysis of the organisms, and probably to an increased excretion of lipase. *A. fumigatus* and the dark coloured strain of *A. flavus* contained more lipase in the dried mould than in the medium. The production of the enzyme appeared to be stimulated when coco-nut oil was substituted for sucrose as the source of carbon.

The lighter-coloured forms of *Aspergillus* produced least acid and most colour in the medium. On autolysis the depth of colour of the medium increased, and its titratable acidity decreased. The four strains of *A. niger* tested differed markedly in the titratable acidity they imparted to the medium; and increase of temperature enhanced these differences, and also brought forth differences in the lipolytic activity of the strains.

Coco-nut oil emulsion was clarified in the shortest time by the *A. niger* strain from copra and by the light-coloured strain of *A. flavus*; the addition of sucrose considerably delayed the clarification of the emulsion.

MURPHY (P. A.) & M'KAY (R.). **A comparison of some European and American virus diseases of the Potato.**—*Scient. Proc. Roy. Dublin Soc.*, xx (N.S.), 27, pp. 347–358, 1932.

This is a brief account of the results so far obtained by the authors in the comparative study of European and American [cf.

*R.A.M.*, xi, p. 739] virus diseases of the potato, as judged by the symptoms caused by individual diseases of either origin when introduced into healthy (i.e., virus-free) President plants. It is pointed out that the work was from the outset greatly hampered by the presence in practically the whole of the American material (both 'healthy' and obviously diseased) of a latent virus or virus complex which had a severe necrotic effect on President, interfering with the development of symptoms attributable to the American disease studied. The results indicated, however, that on the two continents leaf roll, aucuba mosaic, and interveinal mosaic are identical, and that the condition known in Scotland as 'wilding' [ibid., iv, p. 437] is due to a virus and is identical with the American witches' broom. While European simple mosaic (Quanjer's common mosaic) [ibid., iii, p. 415] has not been described from America, the investigation showed that it is of common occurrence in apparently healthy American material, on which, when grown in the field, it produced symptoms similar to those on European varieties; it is believed that this disease may probably be equivalent to the American 'healthy potato' virus. It differs from the American mild mosaic which corresponds more nearly to European crinkle [ibid., xi, p. 739]; the latter is not identical with American rugose mosaic. A streak disease similar to Up-to-date streak [ibid., xi, p. 738] was common in the American 'healthy' and diseased plants, while the American streak was found to be a different disease. Leaf rolling mosaic may have affinities with European para-crinkle [ibid., ix, p. 604]. The identity of the remaining American virus diseases, namely, crinkle mosaic, spindle tuber, giant hill, yellow top, and yellow dwarf [ibid., xi, p. 743], with European diseases was not established in the experiments so far carried out.

BARTON-WRIGHT (E.) & M'BAIN (A.). **Studies in the physiology of the virus diseases of the Potato: a comparison of the carbohydrate metabolism of normal with that of leaf-roll Potatoes.**—*Trans. Roy. Soc. Edinburgh*, lvii, ii (11), pp. 309–349, 16 graphs, 1932.

A full account is given of the authors' investigations under controlled conditions on the mode of carbohydrate formation and the nature of the translocatory sugars in healthy and leaf roll Arran Victory and President potato plants. Special virus-free units were used for control purposes. The disease was transmitted by sprout infection with *Myzus persicae*, which was uniformly successful [*R.A.M.*, iii, p. 161; xi, p. 667].

Variations in the carbohydrate content of the leaf blades and petioles of normal and diseased plants were followed at hourly intervals over 19 and 20 hours at different times (early and late) in the growing season, fluctuations in radiation and temperature being measured at the same time. The carbohydrates estimated in the laminae and petioles were reducing sugars (glucose and fructose), sucrose, and starch. The results were calculated as a percentage of the residual dry weight (dry weight less total carbohydrates). In healthy plants hexose and not sucrose was the first sugar of photosynthesis; the latter is the sugar of translocation and a high degree

of correlation exists between its presence in the leaf blades and in the petioles. In the 'secondary' stage of leaf roll which develops more rapidly in President under greenhouse conditions than in Arran Victory, photosynthesis was found to be much reduced in the early part of the growing season, the main reactions in the laminae being the conversion of starch to hexose, hexose to sucrose, and sucrose back to starch. The same reactions are operative in the leaves of plants in the 'primary' stage of the disease, in which photosynthesis is not reduced to the same extent as in the 'secondary'. In primary leaf roll there is a correlation between the presence of hexose in the leaf blades and in the petioles, so that this substance is the translocatory sugar in diseased plants. Hexose and starch were further found to be directly correlated in the petioles of leaf roll plants, the former apparently travelling down the ground parenchyma and not down the phloem as in normal individuals. Sucrose is absent from the petioles of diseased plants at all times of the day and night, and plays no part, therefore, in the translocatory process. Later in the growing season the starch content of leaf roll plants was found to be much reduced, while photosynthetic activity had increased.

Leaf roll was found in these investigations considerably to reduce the yield of tubers, especially in the very susceptible President, the ratio of healthy to leaf roll tubers being 11·4 : 1 in this variety compared with 1·2 : 1 in Arran Victory. In addition to the prevention by phloem necrosis of free translocation of food materials to the tubers, the absence of sucrose (a highly efficient agent of starch formation) may be involved in the small yields of leaf roll plants.

HARRINGTON (F. M.). **Tuber indexing versus tuber-uniting and roguing in seed Potato production.**—*Amer. Potato Journ.*, ix, 8, pp. 128–131, 1932.

Near the Montana Agricultural Experiment Station two potato plots are maintained for growers' seed stocks, one on dry land and one irrigated. Disease readings are made on all the stocks and yield records taken. During the past exceptionally dry season, the readings in the dry land plot were almost impossible to make, especially in respect of mosaic, whereas in the irrigated plot the diseases were readily identifiable and were further found to have spread even in the apparent absence of aphids.

For a number of years tuber-unit plots of Bliss Triumph and Netted Gem potatoes have been maintained, thorough roguing being carried out annually. It was found impossible, however, completely to eradicate virus diseases on the dry land plot by this method, and tuber indexing was therefore begun. The first season's work showed a remarkably high percentage of disease, chiefly mild mosaic. The tuber-indexed stock was planted back in the field and compared with a non-indexed one, with the result that a marked difference was recorded in favour of the former. Tubers from the indexed field were again indexed the following winter, and showed a very low disease reading compared with the first [cf. *R.A.M.*, xi, p. 667].

On the basis of these investigations the writer concludes that

the work of tuber indexing cannot be conducted by the grower alone, but requires the co-operation of the experiment stations. The Montana scheme is to return to the grower, every year or two years as space permits, a certain quantity of tuber-indexed seed stock. The grower will plant this stock in an isolated tuber-unit seed plot, where it will be carefully rogued, and whence supplies will be sent either direct to the commercial field or to a tuber-unit increase plot, also under special observation.

Brann (J. W.). **Some results of Potato indexing in Wisconsin.** —*Amer. Potato Journ.*, ix, 8, pp. 136–140, 1932.

Some 300,000 bushels of much improved Triumph seed potatoes have been produced by Wisconsin growers through the use of seed stock purified by the tuber-index method [see preceding abstract]. Before this service was instituted eight years ago by the horticultural department of the State experiment station, the inability of the growers to eliminate crinkle mosaic constituted an obstacle to certification. The total number of bushels indexed from 1923 to 1930, inclusive, was 1,085, the yield from the first year's increase stock being 16,800 and from the second 263,000 bushels, respectively. Since the introduction of tuber-indexing there has been a steady decline in the incidence of mosaic, the percentage of applicants for certification in the 0 to 2 per cent. group in 1931 being 96 compared with 18 in 1926, while no applications in the 6 to 10 per cent. class were made since 1928.

The actual work of indexing is begun about 20th November, when each tuber is numbered and one eye piece $1\frac{1}{4}$ in. in diameter and $\frac{1}{2}$ in. deep removed from the stem end. The germination of the seed pieces in pots in the greenhouse is accelerated by raising the temperature to between 70° and 75° F.; after the emergence of the plants this figure is reduced to 60°, at which point it is maintained during the growing period. Disease records are taken when a height of 6 to 8 in. is reached, and the balance of the healthy tubers returned to the grower for planting in a tuber-unit seed plot, while the diseased ones are removed. Some of the more experienced growers send numbered eye pieces instead of tubers, strung in consecutive order in groups of 10 to 20. This method reduces the risk of frost in transit and the cost of labour in handling the tubers. The practice of indexing one or more tubers from selected hills has also been followed, and has given good results where relatively mosaic-free stock is used.

Hintikka (T. J.). **Über die Verbreitung des Kartoffelkrebses in verschiedenen Ländern sowie über einige klimatischen Faktoren der verseuchten Gebiete.** [On the distribution of Potato wart in different countries and on some climatic factors of the infested areas.]—*Valtion Maatalouskoetoiminnan Julkaisuja* 23, 102 pp., 11 maps, 1929. [Finnish, with German summary.]

The writer has examined the available literature on wart disease of potatoes (*Synchytrium endobioticum*) with a view to elucidating the factors (especially climatic) concerned in the distribution of the fungus in different countries. Two groups of factors are dis-

tinguished, endogenous and exogenous. In the former are included the origin of the fungus and its parasitic adaptation to various hosts. Present-day knowledge tends to support the view that *S. endobioticum* is probably indigenous to Europe, whence it has been conveyed to North America and South Africa.

Varietal reaction to the fungus is another important aspect of the endogenous factor-group. A list is given of recognized immune varieties, arranged under their countries of origin, with a discussion of their synonymy and of the conflicting results sometimes obtained with regard to susceptibility and resistance in different countries [cf. *R.A.M.*, x, p. 544; xi, p. 71]. An account is given of the genetic studies that have been carried out on varietal reaction, with observations on the dependence of infection on the degree of contamination of the soil and other subsidiary factors.

Among the exogenous factors governing the occurrence of *S. endobioticum* are included the effects of soil, light, warmth, and moisture, and the dissemination of the fungus by human and animal agency, as well as through unsuitable methods of cultivation, e.g., in mining and industrial centres and allotments, where the dense population and lack of crop rotation favour epidemic infection.

In Finland potato wart occurs only in the districts with the heaviest rainfall, i.e., an annual mean of 650 mm., and is thus confined to the south-west [ibid., x, p. 620] notwithstanding the absence of all restrictions on imports since 1926. The disease is most prevalent in Germany (1,039 localities) in areas with a mean annual rainfall of over 70 cm., the corresponding figures for the averages of 60 to 70, 50 to 60, and 50 cm. or below being 360, 276, and 3, respectively. In Poland potato wart has been detected in a sporadic form in areas with a comparatively low rainfall (eight with an annual mean of 500 to 600 mm. and one or two below 500). Hornyan, Czecho-Slovakia, where *S. endobioticum* was discovered in 1896, is situated in a region where the annual precipitation amounts to between 600 and 700 mm. or exceeds the latter figure, and all the centres of infection recorded in that country up to the end of 1924 were in areas of relatively heavy rainfall. Similar conditions are stated to obtain also in Austria, Switzerland, France, Belgium, Holland, and Great Britain and Ireland. The average rainfall in the Danish infected areas exceeds 650 mm., while in Norway (with one possible exception) precipitation is also rather heavy in the affected localities. In Sweden, on the other hand, the disease occurs in comparatively dry districts. In the United States [ibid., iv, p. 239] and South Africa [ibid., v, p. 444] infection is found in areas with a very high mean annual rainfall. It is apparent from these data that humid conditions are of primary importance, though not absolutely essential, to the development of *S. endobioticum*.

With regard to temperature extremes, it appears that the coldest European centres of infection in Finland and Sweden lie within the isotherms of 3° to 4° C., while the warmest may be placed at 20°, south of which point wart disease is found only in the mountains or in very rainy districts. The climatic type in which the fungus

flourishes is evidently North Atlantic, characterized by relatively cool and damp summer weather, especially in July and August.

NAPPER (R. P. N.). **Observations on the root disease of Rubber trees caused by Fomes lignosus.**—*Journ. Rubber Res. Inst. Malaya*, iv, 1, pp. 5–33, 1932.

In this progress report of experiments in Malaya, commenced by Dr. J. Weir and continued and extended by the writer, on the root disease of *Hevea* rubber trees caused by *Fomes lignosus* [*R.A.M.*, xi, p. 672], it is stated that fructifications of the fungus bearing numerous viable spores are produced abundantly under certain normally recurring climatic conditions which last for considerable periods. Wind-borne infection is therefore highly probable.

Experiments to compare the incidence of the disease in soil which has been cleared of stumps and surface roots (clean-cleared) and where these have been left to rot in the ground (uncleared), respectively, gave results entirely at variance with the ideas prevalent on the subject when they were begun. The first showed that with trees up to three years of age uncleared conditions considerably reduced infection, the figures for per cent. potentiality of attack (100 times the total number of planting holes where *F. lignosus* has developed since planting, divided by the total original stand) for the uncleared and cleared areas being, respectively, 18·6 and 29·4. In a second test the corresponding figures were 9·2 and 20·3, and infection was also found to be less in the areas carrying cover crops than in areas without cover. In a third experiment infection remained negligible in an area (adjoining a highly infected block) in which secondary jungle ('belukar') was allowed to grow up among the rubber trees; when the rubber was three years old the *Fomes* incidence (100 times the number of diseased trees, divided by the total original stand) was only 1·7 per cent., a much smaller figure than that of any other three-year-old field on the station. The curve obtained by plotting the incidence of *F. lignosus* in a young clearing against the amount of timber left in the soil after clearing shows that as the amount of timber left increases from zero, the incidence of infection rises sharply from zero to a maximum and then falls gradually away, until where secondary jungle is allowed to develop, the amount of infected rubber becomes very slight.

To explain these results three postulates are made. (1) That the presence of infection in the soil of a clearing is due chiefly to the presence of the disease in the jungle stand before felling. (2) That the distribution of the disease in the future rubber stand is governed by the original distribution in the jungle, a conclusion which follows from the first. (3) That the fungus does not begin to form rhizomorphs until the food material in the substratum begins to be exhausted. This postulate is supported by general mycological considerations and by observation.

From these postulates the following deductions may be made. (*a*) If all the timber is removed before planting, all danger of infection in the clearing is eliminated. (*b*) If a small amount of generally distributed material is left in the soil, the distribution of infection will be the same as if no material has been removed,

little food will be available for the fungus, and will quickly be exhausted, and rhizomorphs will soon form and progress through the soil until their source of origin is exhausted or they encounter rubber roots, no other material being present to interrupt their progress. The chances of attack upon the young rubber will therefore be considerable. (*c*) If an increasing amount of timber is left in the soil at planting, the food available to the fungus will increase and the formation of rhizomorphs will be delayed. When the rhizomorphs are formed, there will be an increasing amount of timber other than rubber roots in the soil, on which they can feed. In these conditions the chances of attack by *F. lignosus* on the young rubber will be progressively fewer. (*d*) If secondary jungle is allowed to regenerate in a young clearing, the proportion of soil-borne timber belonging to the crop plant will be very small compared with the total amount of material which the fungus can attack. The probability of attack on the crop plant will then be slight.

If sound, these arguments explain why a woody cover crop parasitized by *F. lignosus* reduces the incidence of infection on the rubber trees among which it is planted, the cover crop presenting an enormous amount of food material on which the fungus can feed.

The evidence obtained also suggests that as the rubber tree grows older, the resistance of the roots to *F. lignosus* increases, and that in the soil of a new clearing the fungus stales after a time (this happens in experimental boxes after two or three months). Under jungle conditions *F. lignosus* is probably checked by staling, but the upheaval occasioned by felling and burning favours its development. This may explain why it has an early period of great activity, which rises to a maximum usually between the second and fourth years after planting and gradually declines as the soil conditions become more normal. The presence or absence of rubber trees in a clearing would not affect this, the time when the attack reaches its peak depending on the time of clearing and burning, and not on the time of planting.

The results of the experiments lend an altogether new significance to wind-borne infection (by spores) of the roots of jungle stumps after felling. No doubt remains that spores capable of germination under suitable conditions are released in great numbers and are widely distributed by the wind. Until, however, it has been shown that the spores are able to withstand considerable desiccation, it is advisable to direct control measures so as to deal with infection developing chiefly from vegetative sources present in the jungle before clearing and stimulated into activity by the clearing and burning. The best and cheapest methods of planting are considered to be in descending order of merit: (1) planting under uncleared conditions, and allowing a natural cover of secondary jungle to regenerate, (2) planting under uncleared conditions, with an artificial cover crop, (3) planting under uncleared conditions, with subsequent clean weeding, and (4) planting after all the timber above and below the soil surface has been eradicated.

Before replanting old rubber stands all infected trees should

be removed and well-defined patches of infection should be dug over, all buried timber being removed and destroyed, and the soil thoroughly exposed to the sun. Contrary to the usual opinion, soil treatments against *F. lignosus* and *Ganoderma pseudoferreum* may run concurrently.

As regards curative treatment, great emphasis is laid on the impossibility of planning adequate measurements in any given area until a tree-to-tree inspection has been made and the magnitude of the task correctly assessed. It was definitely ascertained that a 2 per cent. aqueous solution of copper sulphate kills the mycelium of *F. lignosus* provided that the two come into contact. This treatment applied periodically to the roots during the first four or five years after planting prevents the development of an attack on healthy trees.

Laboratory investigations [which are described] showed that the macroscopical vegetative characters of the mycelium isolated from the fructifications, rhizomorphs, and diseased wood were identical; the mycelium from spore cultures was very similar, but grew rather more slowly and produced much aerial growth. Rhizomorphs and fructifications were obtained experimentally from naturally infected material. The most profuse rhizomorph formation took place in the absence of light; in the light there was a tendency to form fructifications which produced spores even in very early stages of development.

A bibliography of 22 titles is appended.

NAPPER (R. P. N.). **A scheme of treatment for the control of Fomes lignosus in young Rubber areas.**—*Journ. Rubber Res. Inst. Malaya*, iv, 1, pp. 34–38, 1932.

The author proposes a new scheme of treatment against *Fomes lignosus* on young *Hevea* rubber based on the results of his recent observations on the disease in Malaya [see preceding abstract]. It has been tested experimentally and is now recommended for use on estates.

Every tree should first be examined at the collar, for a couple of feet along the laterals, and for six to eighteen inches (according to size) down the tap root. If there is any trace of *F. lignosus* the tree should be marked for treatment. Trees which are seen to be diseased without root examination should be removed with all their roots. If the hole so left is not to be replanted, a trench two feet deep by a 'changkol' [native spade] wide should be dug round it outside the radius of the roots and beyond the source of infection, the infected site being first dug over to a depth of two feet and thoroughly exposed to the sun. The trench must be regularly cleaned out. If the hole is to be replanted, the site should be dug over to a depth of three feet, eight feet round the site of the tree, removing all underground wood very carefully. A trench 15 to 20 feet square should be made round the diseased area, and the soil between this trench and the deeply dug area should be dug and roots removed to a depth of eighteen inches, any more deeply buried timber exposed during the operation being also extracted. The central hole should be drenched with 5 galls.

of 2 per cent. copper sulphate one month after digging. Liming is considered to be a waste of time and money.

Trees on which the presence of the disease is only detected on examining the roots should be treated by removing as much as possible of the external mycelium and applying 1 gall. of 2 per cent. copper sulphate to the collar and to all infected surfaces of the roots. The source of the mycelium, if found, must be removed. As the mycelium lives epiphytically on the bark for some time before penetration occurs, it should be possible to prevent healthy trees from attack by applying the treatment at intervals shorter than the time required for the mycelium to penetrate. Intervals of two or three months are sufficient even in heavily diseased areas. Two or three treatments at such intervals may be necessary to gain control over a well-established attack, while in extreme cases two further treatments at intervals of six months may be required to keep the incidence low until the activity of the fungus has abated. If the establishment of fresh infections can be prevented until this natural abatement takes place (usually in the fifth or sixth year) and until the trees are old enough to offer a determined resistance, then successful control will have been obtained.

The costs for each application at the experiment station concerned (which is on easily worked, sandy soil), including labour and material, but not supervision, were as follows: tree-to-tree inspection (100 trees per acre) 15 to 20 cents [100 cents = Straits dollar = 2*s.* 4*d.* at par] per acre for 2-year-old trees, and 30 to 50 cents per acre for 3-year-old trees. In unstumped areas the treatment of trees not requiring root examination cost 70 to 100 cents per tree, the figure for the stumped areas being 60 to 90 cents. The treatment of trees requiring root examination cost 6 to 8 cents per 2-year-old tree, and 6 to 11 cents per 3-year-old tree.

CORNER (E. J. H.). **The identification of the brown-root fungus.** —*Gardens' Bull. Straits Settlements*, v, 12, pp. 317–350, 1 pl., 8 figs., 1932.

The author states that a careful study of the fruit bodies [considerable details of which are given], supported by numerous examinations of diseased material in Malaya and from Ceylon, has established the fact that the brown root rot of rubber trees is caused not, as is usually believed, by *Fomes lamaensis* [*R.A.M.*, xi, p. 72], but by a distinct, although closely allied, species which he considers to be new to science and names *F. noxius*. The same species was also found to be associated with the stem rot of the oil palm (*Elaeis guineensis*) recently described by Thompson [ibid., xi, p. 105], and although specimens were not examined, it is presumed that it also is the cause of the brown root rot of the tea bush formerly attributed to *F. lamaensis* [ibid., x, p. 345]. The error is traced to a mistaken identification by Lloyd of specimens of the brown root rot fungus of Ceylon, sent by Petch, as *F. lamaensis*. The evidence collected so far indicates that *F. noxius* is a facultative parasite, probably widely spread in Africa and in the East, growing mainly in open situations, rarely, if ever, in the

deep forest, while *F. lamaensis* is a saprophyte in the forest, and is very rarely found under estate conditions in Malaya.

Morphologically, *F. noxius* differs from *F. lamaensis* in having wider hyphae, in the absence of hymenial setae, and in the structure of its upper surface. A detailed description [in the form of a comparative table] is given of the structure of the fruit bodies of these two species, and also of the allied *F. pachyphloeus* [ibid., xi, p. 613], in which a variety is distinguished and described under the name *hispidus* n. var. A new variety is also proposed for *F. lamaensis*, for which the name *secedens* n. var. is suggested. Latin diagnoses of all the fungi dealt with are appended. The fruit bodies of *F. noxius* are degenerate in type, and are preceded even on vertical surfaces by a resupinate *Poria* stage of varying extent, while on vertical surfaces the fruit bodies of the other two species are preceded by a typical primordial knob without a *Poria* stage. In none of the three species can detached fruit bodies survive desiccation even if only for a few days.

So far *F. pachyphloeus* has not been found causing disease in estates of Malaya.

MORROW (MARIE B.). **The soil fungi of a Pine forest.**—*Mycologia*, xxiv, 4, pp. 398–402, 1932.

This is a briefly annotated list of 13 genera and 30 species of fungi which were found in the soil of a pine-oak forest in Bastrop County, Texas. Nearly two-thirds of the species belong to the genera *Penicillium* and *Aspergillus*.

COSTANTIN (J.). **La mosaïque de la Canne à Sucre. (Enseignements découlant de sa récente histoire.)** [Sugar-cane mosaic. (What its recent history has taught us.)]—*Agron. Colon.*, xxi, 176, pp. 41–51, 1932.

After a brief historical review of the first discovery and spread of sugar-cane mosaic in various cane-growing countries, the author gives an outline of the different methods which have been suggested and tried for its control, of which the introduction of mosaic-resistant or -tolerant Java canes and their hybrids (P.O.J. canes) has been the most successful. In his opinion this effect is due chiefly, if not exclusively, to the fact that the material from which these canes have been evolved is of mountainous origin, and again supports his views of the curative effect on a wide range of plant diseases of cultivation and breeding at high altitudes [cf. *R.A.M.*, x, p. 454; xi, p. 261, *et passim*].

COSTANTIN (J.). **Hérédité montagnarde acquise par la Canne à Sucre.** [Mountain heredity acquired by the Sugar-Cane.]—*Comptes rendus Acad. des Sciences*, cxcv, 5, pp. 345–347, 1932.

Recent studies on the hereditary resistance to certain degenerative diseases acquired by mountain-grown sugar-canes are briefly summarized [see preceding abstract], and attention is drawn to the correlation existing between this property and thinness of the stems, earliness of ripening, and a low sugar production.

Booberg (G.). **De bergbibitaanplant op Java.** [The cultivation of mountain setts in Java.]—*Arch. voor Suikerind. Nederl.-Indië,* Deel ii, xl, 37, pp. 761–767, 2 diags., 1932.

Sereh disease of sugar-cane being no longer of any practical importance in Java owing to the extended cultivation of the highly resistant P.O.J. 2878 variety [*R.A.M.*, ix, p. 161; x, p. 299], the area occupied by the hill nurseries whence guaranteed planting material was supplied to plantations in the plains [ibid., vii, p. 403] has sunk from 11,500 hect. in the years immediately preceding 1926 to 129 hect. in 1932.

**Work connected with insect and fungus pests and their control.** —*Rept. Agric. Dept. St. Kitts-Nevis, 1931,* p. 6, 1932.

In St. Kitts, West Indies, the position as regards gumming disease of sugar-cane [*Bacterium vascularum*: *R.A.M.*, viii, p. 464] is now satisfactory, the two chief varieties grown, B.H. 10(12) and S.C. 12/4, being highly resistant. Small markings were present on the leaves of P.O.J. 2878 at the Experiment Station, but no stem infection was observed. On B. 726, however, leaf symptoms were fairly general, and plantings of this variety will not be extended until more has been learned about its resistance. B. 417, B. 381, B. 374, and G. 119 appear to be very resistant.

Campos Goes (O.). **A doença da raiz da Cana em Pernambuco.** [The root rot of Sugar-Cane in Pernambuco.]—Reprinted from *Bol. Sec. Agric.*, 43 pp., 1932.

After a description of the external and internal symptoms of root rot of sugar-cane in Pernambuco, Brazil, the writer proceeds to a critical examination of the various factors implicated in this disease. The foremost cause of the condition would appear, from these investigations, to be the unfavourable constitution of the soil in the affected area, the roots of the plants being asphyxiated and injured by the compact, hard, and stony consistency of the ground and subsoil. The consequent metabolic disturbances are accompanied by reduced root formation, atrophy, splitting of the cane, and death of the leaves and stems. All other agencies (fungi, nematodes, toxic soil substances, and the like) are either absent or of minor importance in the districts under observation.

The condition has not been proved to be infectious, but it is more difficult to control than mosaic in Pernambuco, where it is believed to have existed for some time, affecting the Manteiga and other local varieties. The damage caused by the root rot complex is very severe and likely seriously to impair sugar production. Prophylactic measures should include rational preparation of the soil and the development of resistant varieties.

Guba (E. F.). **Monograph of the genus Pestalotia. Part II.**—*Mycologia,* xxiv, 4, pp. 355–397, 4 figs., 1932.

In this second part of his monograph of the genus *Pestalozzia* [*R.A.M.*, viii, p. 605], the author describes 45 further species. In a foreword he states that the different species can be adequately defined for monographic purposes on the basis of their morphological and macroscopical characters. A cursory review of the

relevant literature leads him to believe that very little, if any, importance is to be attached to published reports of the parasitism of species of *Pestalozzia* on plants, since, as a rule, they are found in organs that have perished from other causes, and are usually associated with other parasites or saprophytes. In his opinion, the interest presented by the genus is mostly taxonomic. A key to the identification of 73 species hitherto discussed in these studies is appended.

BUTCHER (R. W.). **Contribution to our knowledge of the ecology of sewage fungus.**—*Trans. Brit. Mycol. Soc.*, xvii, 1–2, pp. 112–124, 1 pl., 1932.

In this paper the author discusses in some detail the ecological conditions which, in English rivers and streams, govern the appearance and development of species of the Schizomycetes and true fungi composing the community of polysaprobic micro-organisms commonly known in all sewage engineering works as the 'sewage fungus'. The only two species of fungi so far found in English and Irish running waters are *Leptomitus lacteus* [*R.A.M.*, x, p. 680] and *Fusarium aquaeductum* (Radl. & Rabenh.) Sacc. The first forms mycelial tufts of a cotton wool-like context; it occurs in waters containing highly diluted, decomposed organic matter, such as, for instance, those of the river Trent below a beet sugar factory in 1927, when the season was exceptionally wet and the river remained very full and flooded throughout the season. The second occurs chiefly in acid waters, and gives a growth similar to that of *L. lacteus* but coarser, less mucilaginous, and frequently of a pink tint. Both fungi are stated to be found in Great Britain only under somewhat exceptional circumstances.

HOPKINS (J. C. F.). **Leaf curl of Tobacco in Southern Rhodesia.** —*Rhodesia Agric. Journ.*, xxix, 9, pp. 680–686, 1 pl., 1932.

Since Storey's observations on leaf curl of tobacco in Southern Rhodesia [*R.A.M.*, xi p. 676], serious outbreaks of the condition locally known as 'crinkle' have been reported from various parts of the Colony and diagnosed, by comparison with Storey's photographs, as identical with the Amani curl disease [ibid., xi, p. 76]. With a view to explaining the occurrence of sudden epidemics of 100 per cent. leaf curl in early tobacco plantings, a search was made among the previous year's plants that had escaped the plough, resulting in the detection of numerous 'suckers' showing the typical symptoms of the disease and bearing hundreds of insects in process of breeding.

The following experiment was carried out in order to verify Storey's conclusions. Tobacco seedlings, raised from seed under insect-proof conditions, were potted out in rich soil in a fumigated, screened greenhouse and covered with Dietz lamp glasses, into which whiteflies (Aleurodidae) from leaf curl plants were introduced, three days later, at the rate of 25 per plant. Ten plants were grown under lamp glasses without whiteflies and served as controls. The lamp glasses were removed after a week and the seedlings washed with 1 in 250 nicotine and soft soap and replaced in the greenhouse. A fortnight later some of the infected plants

showed clearing of the leaf veins and slight curling of the midribs and laminae. Within three weeks eight of the ten treated plants exhibited the typical symptoms of leaf curl, including curling of the foliage, thickening of the veins, and large, leafy outgrowths (enations) from the lower sides of the veins. All the controls remained healthy.

SMITH (K. M.). **Studies on plant virus diseases. XI. Further experiments with a ringspot virus; its identification with spotted wilt of the Tomato.**—*Ann. of Appl. Biol.*, xix, 3, pp. 305–330, 5 pl., 7 figs., 1932.

This is an account of the author's further investigation of the ring spot virus of *Solanum capsicastrum* [*R.A.M.*, x, p. 614], and of the experiments in which he established the transmissibility of this disease by *Thrips tabaci* [ibid., x, p. 694]. The latter part of the work indicated that previously non-infective larvae can transmit the virus only after the lapse of five days from the moment they are placed on the source of infection, and also established the fact that non-infected adult insects cannot pick up the virus *de novo*. It also tends to throw doubt on the author's previous experiments implicating *Myzus persicae* as an occasional transmitter [ibid., x, p. 615], since they did not preclude the possibility of the entrance of some infective thrips to the plants.

Cross-inoculation experiments [details of which are given] proved the identity of the *S. capsicastrum* virus with the spotted wilt of tomatoes recently described from Cardiff [ibid., x, p. 694] which is considered to be identical with the Australian form of this disease [ibid., xi, p. 549]. It is believed highly probable that spotted wilt has been present in the British Isles for some years, and has been at times recorded as tomato mosaic, streak, or stripe. A study of the host range of this virus showed that all the species of Solanaceae tested, twenty in number, and including potato, tobacco, chilli pepper, eggplant, and petunia, are susceptible to it, and it was also transmitted to lupins, dahlias, asters, zinnias, and plantains (*Plantago*).

A comparative study of some of the properties of the spotted wilt virus and those of a tomato virus of the stripe or mosaic type with which it is associated in the plants, showed that while the former does not filter through an $L_1$ Pasteur-Chamberland candle, and loses its viability after four hours' ageing *in vitro*, the latter passes through all grades of these candles up to $L_{13}$, and remains viable for many weeks under similar conditions. The latter virus is also much more infective than the former, the infective power being of the same order as that of the tobacco mosaic viruses.

KOSTOFF (D.) & KENDALL (J.). **Origin of a tetraploid shoot from the region of a tumor on Tomato.**—*Science*, N.S., lxxvi, 1963, p. 144, 1932.

Out of 120 tomato plants inoculated internodally in the spring of 1931 with *Bacterium tumefaciens*, 109 developed tumours. When the stems were cut off above the tumours shoots developed in some cases from the latter. These shoots, together with a small portion of the stem and the tumour, were removed and rooted in

soil. One of the resulting plants proved to be tetraploid. All the roots from this shoot, which developed at 3 cm. and more above the point of origin from the tumorous stem, showed 48 somatic chromosomes compared with 24 in the original plant. On separation and transplantation two months later, the shoot developed into an apparently normal plant, except for the slightly larger flowers.

Polyploidy in this case is evidently not a cause of tumour formation, as is sometimes suggested.

WEBER (G. F.), HAWKINS (S.), & KELBERT (D. G. A.). **Gray leaf-spot, a new disease of Tomatoes.**—*Florida Agric. Exper. Stat. Bull.* 249, 35 pp., 14 figs., 1932.

An expanded account is given of the grey leaf spot disease of Florida Globe, Marglobe, and Earliana tomatoes caused by *Stemphylium solani* [*R.A.M.*, xi, p. 771], the losses from which were estimated at 5 per cent. of the crop of 1925, 1926, and 1927, 15 per cent. in 1928, 10 per cent. in 1929, and 2 per cent. in 1930 and 1931. Natural infection by *S. solani* has been found on *Physalis pubescens*, eggplant, and [chilli] pepper, which suffered considerable defoliation, as well as on the weeds *Solanum aculeatissimum*, *S. blodgettii*, and *S. verbascifolium*. A number of other Solanaceae [which are listed] proved susceptible in inoculation experiments, including *S. carolinense*, *S. nigrum*, and potato.

Discussing the taxonomy of the causal organism, the authors state that it was placed in the genus *Stemphylium* rather than in *Alternaria* on account of its beakless spores and failure to form spore chains [ibid., xi, p. 393]. During the seven years in which this fungus has been cultured on various nutrient media, no trace of saltation has been observed.

Natural infection of tomato seedlings takes place on emergence from the soil and may continue throughout the life of the plant, all the aerial parts of which except the fruit are liable to attack. The hyphae penetrate the epidermis between the cells or through the stomata. Visible symptoms of infection appear in about three days. The short, erect conidiophores protrude from the stomata or directly through the epidermis of the killed cells, conidia being produced at their tips within a few hours. The spores have been found to retain their viability for periods of 19 months, and to be disseminated over long distances by the wind.

LINDEIJER (EGBERTHA J.). **De bacterie-ziekte van de Wilg veroorzaakt door Pseudomonas saliciperda n. sp.** [The bacterial disease of the Willow caused by *Pseudomonas saliciperda* n. sp.]—Thesis, University of Amsterdam (Hollandia-Drukkerij, Baarn), 82 pp., 4 pl., 4 figs., 1932. [English summary.]

After an exhaustive description of the external and internal symptoms of the bacterial disease affecting willows (*Salix alba*, *S. amygdalina*, and *S. purpurea*) in Eemland, Holland, the writer fully discusses her standpoint in regard to the connexion between this disease and that attributed by Day in England to *Bacterium salicis* [*R.A.M.*, xi, p. 411].

A comparison of the external and internal symptoms in both countries indicates the substantial identity of the two diseases, though certain minor differences are apparent. Day [ibid., iv, p. 322] and the writer both observed, as the first symptom of attack, the sudden wilting and death of the leaves and tops of the young shoots on one or more branches. The former, however, did not mention the feather-like shrivelling up towards the midrib of the leaves near the seat of infection. Day's observation that infection occurs primarily on the overshadowed parts of the crown was not confirmed by the writer, but it is true that the insect vector of the disease, *Cryptorrhynchus lapathi*, prefers the shaded portions of the tree; hence the importance of wide spacing as a control measure. In England the death of the branches ceased in July, whereas in Holland it continued throughout the summer until September. The exudation of bacterial slime was only detected by Day in May and June on the sites of fresh insect injuries, while the writer also noticed this symptom from May till the end of August in the axils or under the points of insertion of small lateral twigs, in leaf scars, and in cortical fissures. Possibly meteorological differences in the two countries may account for these discrepancies. The cortical discoloration associated with the bacterial disease in Holland is not mentioned by Day, and may have been obscured by the simultaneous presence in the affected English trees of *Cytospora chrysosperma*. According to Day, infection spreads more rapidly down the trunk than upwards, but this difference was not apparent in the Dutch trees examined.

The bacterium isolated by the writer from diseased material and successfully inoculated into healthy trees was found to differ in various respects from *Bact. salicis*, and as it was impossible to obtain a culture of the latter for comparison, the Dutch organism is regarded as distinct on the basis of the under-mentioned and other disparities and named *Pseudomonas saliciperda* n. sp. The average length of the latter is 1·7 $\mu$ compared with 0·8 to 1 $\mu$ for *Bact. salicis*. The granular consistency of the colonies, the dendriform outgrowths, and the fimbriate edges characteristic of Day's organism were absent in the author's cultures of *P. saliciperda*. The colour of *Bact. salicis* on potato is yellow and it turns the medium brown, while *P. saliciperda* is dirty white to lead-grey and turns the potato the latter colour; starch is utilized by Day's organism but not by the writer's. In further contrast to *Bact. salicis*, *P. saliciperda* is Gram-negative and reduces nitrates to nitrites. The optimum temperature for the growth *P. saliciperda* is 25° to 30° C.

The differences between the Dutch and the English organisms do not, in the writer's opinion, prove that different diseases are involved, especially as only one of Day's inoculation experiments with *Bact. salicis* gave positive results. Possibly his tests were not performed with pure cultures of the organism, or he may have been working with *P. saliciperda* but omitted to describe all its characters.

Inoculation experiments showed that *P. saliciperda* makes rapid progress in the trees, having already penetrated to the roots when the first external symptoms become apparent. The beetle *C.*

*lapathi* was invariably found near naturally diseased trees and traces of its feeding could be seen both on healthy and diseased twigs. Experiments showed that, in the course of feeding, the insect wounds the bark and penetrates the wood; the bacteria are thus readily transferred from diseased to healthy vessels and the disease perpetuated. When a beetle was allowed to feed first on infected and then on healthy twigs, the latter developed the typical discoloration of the wood and some of the vessels were found to be swarming with bacteria.

*P. saliciperda* is a vigorous parasite in Holland and no evidence was obtained that its activity is restricted to trees growing under unfavourable conditions; the most severe symptoms were frequently found on vigorously growing willows. The removal of such sources of infection as old, semi-decayed pollard willows is advocated by Day and this measure must be approved on general grounds, though there is no reason to suppose that trees of this kind are particularly liable to attack. In order to check the further spread of the bacterial disease in Holland, means must be sought of combating the insect vector, and a study should also be made of the possibilities of control through varietal resistance.

NĚMEC (B.). **Jaraia salicis.**—*Studies Plant Physiol. Lab. Charles Univ. Prague*, iv, 1, pp. 1–21, 24 figs., 1931. [German, with English summary.]

A detailed account is given of the Saprolegniaceous fungus, *Jaraia salicis*, originally described by the writer (*Bull. Int. Acad. Bohem. Prague*, 1913) as a parasite of the root tips of willows (*Salix purpurea, S. viminalis, S. amygdalina,* and *S. fragilis*), on which it causes swellings, in Czecho-Slovakia.

The hyphae are intercellular and contain numerous small, lenticular, granular nuclei. Zoosporangia are formed in short chains, the uninuclear zoospores being differentiated by a process of cleavage and escaping through several short exit tubes. The multinucleate antheridia and oogonia both arise terminally on special hyphae. Fertilization by a simple tube was observed and the male and female nuclei are stated to fuse in pairs. The uninuclear, uniguttulate, multiple oospores are originated by furrows spreading radially outwards from the central vacuole, the segments rounding off and developing a thick, smooth wall. The reduction division probably occurs at the germination of the oospore. Although the mode of oospore development is not altogether typical of the Saprolegniaceae, the author thinks the willow fungus should be referred to this family, possibly as the representative of a special sub-family.

VOGLINO (P.). **Intorno ad un deperimento del Pioppo canadense.** [On a die-back of Canadian Poplar.]—*La Difesa delle Piante*, ix, 3, pp. 33–34, 1932.

Young branches of Canadian poplars [*Populus canadensis*] from various parts of Italy have been found with lesions of a cankerous nature, measuring up to 12 or 15 cm. long and about a quarter as much broad. They were covered by a purplish or violet crust consisting of masses of globose, slightly echinulate, amethyst-

coloured conidia on short, densely crowded conidiophores. Morphologically, the fungus resembled a *Tuberculina*. The condition is considered to be only a transitory effect of no pathological importance, the organism found on the lesions being probably a saprophyte.

VOGLINO (P.). **La marcescenza del fusto nella Araucaria imbricata.** [Trunk rot of *Araucaria imbricata.*]—*La Difesa delle Piante*, ix, 2, pp. 17–20, 4 figs., 1932.

Young *Araucaria imbricata* trees growing in a nursery in Italy became affected by a serious die-back. The leaves turned yellow and the trunk became abnormally swollen for a few centimetres above the collar. The bark was readily detached or shredded, and a colourless, viscid liquid oozed out.

The diseased material contained a dense weft of fuliginous hyphae passing between the necrosed cells of the periderm and phellogen and between the phloem and wood. Conical, ostiolate pycnidia, isolated or arranged in groups of two to four, were visible near the top of the swollen part and towards the base of the leaves. They were pluriloculate, and contained oblong-fusoid, hyaline pycnospores, 24 to 27 by 5 $\mu$, borne on cylindrical stalks measuring 12 to 14 by 5 $\mu$.

The fungus is referred to the genus *Fusicoccum* and is named *F. araucariae* n. sp.

Associated with the thick, dark mycelium, dark stromata were noted especially at the base of the leaves, bearing 2 to 4 spheroidal perithecia with elongated, clavate asci measuring 140 to 160 by 15 $\mu$ and containing 8 subdistichous, elliptical or fusoid-elongated ascospores, 20 to 25 by 8 $\mu$. In one stroma a pycnidium occurred alongside a perithecium containing ascospores. The perithecial fungus is named *Cryptosporella araucariae* n. sp.

In hanging drop cultures the pycnospores germinated rapidly at 12° to 20° C.; after twenty days at the outside pycnidia with mature pycnospores had formed. In agar decoction germination was slower, but the stromatic masses containing pycnidial cavities were more numerous. After two months a perithecial stroma was observed with developing asci of the *Cryptosporella* type. The *Cryptosporella* spores also germinated in the decoctions, but only stromatic masses were obtained, without any special fructifications.

It is concluded that the *Cryptosporella* is the perfect stage of the *Fusicoccum* and Latin diagnoses are given of the new species.

VAN VLOTEN (H.). **Rhabdocline pseudotsugae Sydow, oorzaak eener ziekte van Douglasspar.** [*Rhabdocline pseudotsugae* Sydow, the cause of a disease of Douglas Fir.]—Thesis, Wageningen Agricultural College (C. A. Mees, Santpoort), 168 pp., 4 col. pl., 43 figs., 1 map, 1932. [German summary.]

A comprehensive survey is given of the writer's continued investigations on the disease of Douglas fir (*Pseudotsuga douglasii* and *P. glauca*, considered by some to be only varieties of *P. taxifolia*), caused by *Rhabdocline pseudotsugae* in Holland [*R.A.M.*, x, p. 140].

It was found impossible to grow the fungus (which can persist for months in the living cells of the host without killing them) on

artificial media. *R. pseudotsugae*, therefore, must be ranked among the obligate parasites, such as the Uredineae and Erysiphaceae. Unlike the latter, however, the Douglas fir parasite does not form spores for nearly a year after infection, and then only if the diseased needles remain on the tree; the apothecia do not develop, as they do in *Lophodermium pinastri* on *Pinus sylvestris*, on fallen needles.

Infection occurs by the early development of a narrow infection hypha from the germ-tube of the ascospore, which penetrates the cuticle apparently by mechanical pressure. Both surfaces of the needle can be penetrated. The cells are entered and may eventually be filled with hyphae. Only the chlorenchyma is attacked, the endodermal cells and central cylinder remaining free from invasion. Later on an intercellular mycelium develops and gives rise to the apothecial stromata, the development of which, and of the asci and spores, is very fully described. The author does not consider that the occurrence of a conidial stage in the life-history has been clearly established.

The factors determining resistance to *R. pseudotsugae* are not yet completely understood. A. Henry and M. G. Flood (*Proc. Roy. Irish Acad.*, xxxv, p. 67, 1918–20) detected a marked difference in odour between the needles of the resistant Pacific Coast, Oregon, or green Douglas fir (*P. douglasii*) and those of the susceptible Rocky Mountains, Colorado, or blue variety (*P. glauca*), the latter containing a high percentage of turpentine and various esters which are absent from the former. Anatomical differences in the structure of the needles also occur, those of *P. glauca* being stiffer, with a well-developed hypoderm and numerous idioblasts, while in *P. douglasii* the hypoderm is inconspicuous and the idioblasts absent. The fungus can only penetrate young needles, older ones acquiring resistance through the formation of cutinized layers and the secondary thickening of the outer wall of the epidermis. In greenhouse tests a large number of two-year-old seedlings of *P. douglasii* were successfully infected by *R. pseudotsugae*, but this need not necessarily be interpreted as pointing to the existence of a biologic form of the fungus. Both the green and the blue varieties contain individuals in which the parasite develops without killing the host cells, while in others a few needle cells die shortly after penetration by the hyphae, the growth of the latter being arrested. In this connexion it is a striking fact that no cork formation takes place in the needles of resistant trees, the sole reaction to invasion being that of the living chlorenchyma cells, expressed by the exudation of intercellular drops. No other hosts than the Douglas fir are known.

The view that *R. pseudotsugae* was introduced into Germany from Scotland or Holland [*R.A.M.*, xi, p. 141] by natural means cannot be accepted on the basis of the author's observations, which render it highly improbable that the ascospores of the fungus can travel through the air for such long distances. It is considered much more likely that infection reached Holland with a consignment of trees from a German nursery. Stringent nursery precautions are, in fact, the strongest safeguards against the further dissemination of *R. pseudotsugae*.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

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ROHDE (T.). **Das Vordringen der Rhabdocline-Schütte in Deutschland. Die Folgen des Rhabdocline-Befalls in deutschen Douglasienbeständen. Welche Douglasien sind in Deutschland durch Rhabdocline gefährdet?** [The advance of the *Rhabdocline* leaf fall in Germany. The results of the *Rhabdocline* attack in German Douglas Fir stands. Which Douglas Firs are jeopardized in Germany by *Rhabdocline*?]—*Forstarchiv*, viii, 14, pp. 247–249; 18, pp. 317–326; 22, pp. 389–392, 5 figs., 3 diags., 5 graphs, 1 map, 1932.

An attempt has been made at the Hann.-Münden Botanical Institute to ascertain the distribution of the leaf fall (*Rhabdocline*) [*pseudotsugae*] of Douglas firs [*Pseudotsuga taxifolia*] [*R.A.M.*, xii, p. 63] in Germany and the date of primary infection. In May, 1932, some 25 silvicultural districts had been reported to the Eberswalde College of Forestry (according to an oral communication from Prof. J. Liese) as infected by this disease, chiefly in Pomerania, Mecklenburg, Brandenburg, and Silesia [ibid., xi, p. 141]. Prof. v. Tubeuf states that two areas are infected in Lower Franconia and three in the Palatinate. Primary infection is thought to date from 1922.

The incidence of attack by *R. pseudotsugae* has been found to vary considerably in different seasons. In 1931 a temporary decline of infection was observed in many cases. Meteorological studies are desirable in this connexion. Trees subject to persistent infection showed a marked shortening of the annual height increments and narrowing of the annual rings. So far it has not been possible to determine the length of time elapsing between primary infection and the death of a tree, but there is reason to believe that this is considerable. There is no question at present of the imminent destruction of entire stands by the leaf fall disease.

Discussing varietal reaction to *R. pseudotsugae*, the writer agrees with the general view that the blue and grey (*glauca* and *caesia*) varieties are more susceptible than the green (*viridis*), but the differences, in his opinion, are not very great. The green varieties do not appear to be completely immune, nor are the blue and grey ones so extremely susceptible as is frequently reported. Most of the infected stands were found to range from 13 to 37 years of age, the greatest liability being from 15 to 30 years; only in one

area in the extreme north-west were two-year-old seedlings attacked. No indication has yet been obtained of the superiority, in respect of freedom from leaf fall, of mixed over pure Douglas fir stands.

TUBEUF [C. v.]. **Rhabdocline-Erkrankung an der Douglasie und ihre Bekämpfung.** [*Rhabdocline* disease of the Douglas Fir and its control.]—*Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz*, xlii, 9, pp. 417–426, 7 figs., 1932.

The writer briefly summarizes the available knowledge on the life-history and mode of infection of *Rhabdocline pseudotsugae*, which has been detected in a few localities of North Germany on Douglas fir [*Pseudotsuga taxifolia*: see preceding abstract]. An urgent plea is made for the strict regulation of the importation of conifers, nursery inspections, and the extended cultivation of the resistant green [*viridis*] varieties.

WOLLENWEBER (H. W.) & RICHTER (H.). **Die Douglasienschütte und ihr Erreger, Rhabdocline pseudotsugae Syd.** [The leaf fall of Douglas Firs and its agent, *Rhabdocline pseudotsugae* Syd.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xii, 9, pp. 71–74, 4 figs., 1932.

A concise account is given in semi-popular terms of the distribution, symptoms, life-history, course of infection, and control of *Rhabdocline pseudotsugae*, the agent of leaf fall of *Pseudotsuga taxifolia* in Germany and elsewhere [see preceding abstracts], with notes on varietal susceptibility.

GEYR (H. v.). **Nochmals: Rhabdocline.** [To return to *Rhabdocline.*]—*Forstarchiv*, viii, 14, pp. 241–245, 1932.

The writer maintains his standpoint, in opposition to v. Tubeuf and Liese [*R.A.M.*, xi, p. 141], that the best method of combating the Douglas fir [*Pseudotsuga taxifolia*] leaf fall (*Rhabdocline*) [*pseudotsugae*: see preceding and next abstracts] in Germany is by the gradual development of resistant or immune varieties. For this purpose the establishment of special official nurseries is advocated, one in eastern and another in western Germany, in which prospective planting material, mainly of the north-eastern grey [var. *caesia*] type, could be thoroughly tested by exposure to infection through contact with susceptible varieties. The proposed legislative measures would necessarily put a bar to this project, in which the writer sees the most feasible means of overcoming the disease.

LIESE (J.). **Bemerkungen zu vorstehenden Ausführungen.** [Comments on the foregoing observations.]—*Forstarchiv*, viii, 14, pp. 245–247, 1932.

The establishment of special nurseries for the development of Douglas fir [*Pseudotsuga taxifolia*] varieties immune from *Rhabdocline* [*pseudotsugae*: see preceding and next abstracts] is not regarded by the writer as a practicable control measure. It is improbable that seedlings would contract infection from neighbouring centres of disease, the youngest trees hitherto observed by the writer to be attacked being 15 to 16 years old. The danger

that if the fungus is allowed to multiply the hitherto immune green varieties [*viridis*] may become liable to infection by new physiologic forms of the fungus makes the immediate felling of diseased trees advisable.

GEYR (H. V.). **Rhabdocline-Bekämpfung.** [*Rhabdocline* control.]—*Forstarchiv*, viii, 18, pp. 326–327, 1932.

Liese's objections to the establishment of nurseries for the cultivation of Douglas firs [*Pseudotsuga taxifolia*] immune from *Rhabdocline* [*pseudotsugae*: see preceding abstracts] are discussed and refuted. The possibility of the evolution of new physiologic forms of the fungus is regarded as remote. Quite young trees are stated to become infected in America. It would, however, be quite possible to let the trees grow to a certain size before infecting them, thereby curtailing the period of sporulation.

BADOUX (J.). **Nouvelle épidémie de la rouille des aiguilles de l'Épicea.** [A new rust epidemic on Spruce needles.]—*Journ. Forest. Suisse*, lxxxiii, 9–10, pp. 232–233, 1932.

A fresh outbreak of the spruce rust due to *Chrysomyxa abietis* (*C. rhododendri*) [*R.A.M.*, xi, p. 553], which caused such heavy damage in Switzerland in 1927 [cf. ibid., vii, p. 686], has recently been recorded from Valais, Oberland, and St. Gall. The attacks are stated to be of intense severity and clouds of orange spores have been blown about by the wind.

LINDGREN (R. M.). **Field observations of needle rusts of Spruce in Minnesota.**—*Plant Disease Reporter*, xvi, 12, pp. 126–129, 1932. [Mimeographed.]

A needle rust of spruce occurred in epidemic form in Minnesota forest nurseries during the summer of 1927, the most susceptible species being *Picea mariana* and *P. pungens* var. *engelmanni*, followed in decreasing order by *P. glauca* and its var. *albertiana* and *P. excelsa*. Defoliation amounted to between a quarter and three-quarters of the current year's needles in severe attacks. Later on heath plants growing near the infected spruce stands bore the uredo stage of *Melampsoropsis* [*Chrysomyxa*] *cassandrae* on *Chamaedaphne calyculata* and of *M. abietina* [*C. ledi*] and *M.* [*C.*] *ledicola* on *Ledum groenlandicum*. Of these the first-named was the most prevalent, while *C. ledicola* appeared to be of little account. *Andromeda glaucophylla* was also found in some cases to bear uredospores in the neighbourhood of the infected spruce. The relation between *C. cassandrae* and *Peridermium consimile* on spruce was shown by Clinton (*Ann. Rept. Connecticut Agric. Exper. Stat.*, 1907–8, p. 369), while the other two species were shown to infect spruce by Fraser (*Mycologia*, iii, pp. 67–74, 1911). The aecidial stages of all three rusts on spruce needles are very difficult to distinguish morphologically. A small number of inoculation tests from spruce on *L. groenlandicum* and *C. calyculata* supported field observations on the relative prevalence of the rusts.

GILL (L. S.). **Notes on the pycnial stage of Peridermium cerebroides.**—*Mycologia*, xxiv, 4, pp. 403–409, 3 figs., 1932.

In this paper the author reports the first discovery in 1930 in

the Santa Cruz Mountains, California, at an altitude of about 1,500 feet, of the pycnidial stage of *Peridermium* (?) *cerebroides* [*R.A.M.*, viii, p. 684] on *Pinus radiata* and *P. attenuata*. The pycnidia were only found on young galls, lying just below the periderm of the host, during the winter months. They were rare and considerably smaller than those of *P. cerebrum* [loc. cit.]. The sorus appears to be borne on a uninucleate mycelium, and in most of its morphological details it agrees with similar structures typical of the caulicolous species of *Peridermium*.

LIESE [J.]. **Merkblatt zur Schüttebekämpfung.** [Memorandum on leaf fall control.]—*Merkbl. Hauptstelle forstl. Pflanzensch. Eberswalde*, Bot. Ab., 4 pp., 2 figs., J. Neumann, Neudamm, [? 1932. Abs. in *Forstwissensch. Centralbl.*, liv, 20, p. 715, 1932.]

A pamphlet dealing with leaf fall of pines [*Lophodermium pinastri*] and its control [*R.A.M.*, xi, p. 486] in Germany has been prepared by the writer to replace v. Tubeuf's publication on the subject, written in 1905 and now out of print. Notes on some of the new copper-containing fungicides are included.

FINDLAY (W. P. K.). **A study of Paxillus panuoides Fr. and its effect upon wood.**—*Ann. of Appl. Biol.*, xix, 3, pp. 331–350, 3 pl., 2 figs., 1 graph, 1932.

This is a full account of the cultural and biological study of *Paxillus panuoides*, a summarized report of which has already been noticed [*R.A.M.*, xi, p. 448]. Additional points of interest are that, in pure culture on 2 per cent. malt agar with 1 per cent. malic acid, the fungus grew within a restricted range of temperature, with a lower limit at about 5° and an optimum between 23° and 25° C., while no growth occurred above 29°. It grows best on acid media and can grow on malt agar acidified to $P_H$ 2. It was shown to be very sensitive to antiseptics, indicating that its growth may readily be checked by a low concentration of an efficient wood preservative [cf. ibid., xi, p. 816]. No evidence of the presence in its mycelium of an oxidase or peroxidase was obtained, the predominating enzyme appearing to be hydrolytic in nature. The paper terminates with a brief description of macroscopical details permitting of the identification of the timber decay due to *P. panuoides* (which causes a brown rot affecting mainly the cellulose and leaving the lignin practically untouched), and with some suggestions for its control.

**Intelligence and minor investigations.**—*Dept. Sci. & Indus. Res., Rept. Building Res. Board for the year 1931*, pp. 104–145, 1932.

Among the special problems investigated by the Building Research Board in 1931 was the liability of wooden floors to develop dry rot [*Merulius lacrymans*: *R.A.M.*, xi, pp. 343, 487] when laid direct on concrete. A very large number of cases of decay of floors from this cause has been reported, and the common use of impermeable linoleums prevents the drying out of the moisture rising from below. Only a completely impervious layer of bitumen is likely to prove satisfactory in checking the ascent of

moisture from the ground, the efficacy of brush-applied coatings of preservative on the floor timbers being very doubtful unless made with extreme care. Instances have been observed in which the fungus gained access to surface-treated timber by way of cut ends and cracks, completely destroying the interior of the wood and leaving a shell of unattacked substance.

ROBAK (H.). **Investigations regarding fungi on Norwegian ground wood pulp and fungal infection at wood pulp mills.** —*Nyt Magazin for Naturvidenskaberne*, B, lxxi, pp. 185–330, 32 figs., 1932.

A comprehensive and fully tabulated account is given of the author's investigations from 1929 to 1931 on the part played by fungi in the deterioration of wood pulp before and during storage in Norwegian mills. The main object of the work was the systematic study of the fungi concerned, but some tentative observations are made as to the possible sources of infection (air rather than the timber or water being the most prolific) in relation to storage methods and other practical aspects of the problem.

Pure cultures were made of over forty organisms isolated from pulp samples, and detailed morphological descriptions are given of 28, including five new species, viz., *Myxotrichum carminoparum*, *Ceratostomella stenoceras*, *Oidiodendron nigrum* n. g., n. sp., *O. fuscum*, and *O. rhodogenum* (with Latin diagnoses). The new genus is characterized by slender, septate hyphae which are hyaline when immersed, but may darken in the aerial growth, and well-differentiated, erect, arborescent conidiophores, the branches of which divide up into oval to round, unicellular, coloured or hyaline spores. Although *O. nigrum*, by reason of its brown aerial hyphae and dark conidia, belongs to the Dematiaceae as generally understood, while *O. rhodogenum*, with pale conidia and hyaline mycelium, is a member of the Mucedineae, the separation of the three naturally connected forms under discussion is considered to be impracticable.

Other important species detected in the 54 'air analyses' made at two mills, in which Petri dishes containing wort agar were placed for one hour or one day, included *Cladosporium herbarum* (31), *Trichoderma lignorum* (27), *Hormonema pullulans* (23), *Cadophora fastigiata* (14) [*R.A.M.*, xi, p. 14], and B 7, a rapidly growing, unidentifiable, sterile, pale scarlet mycelium (14).

Conspicuous changes in the colour of the pulp were produced by *M. carminoparum*, mycelium B 7, and *O. rhodogenum* in the form of diffusible, red pigments, while *H. pullulans*, *C. fastigiata*, *Cladosporium herbarum*, and to some extent *Discula pinicola* var. *mammosa* [ibid., ix, p. 76] cause dark staining. None of the 35 species found on manufactured wood pulp affected the consistency of the material during a period of six to twelve months. The fibres were slightly attacked by *Epicoccum purpurascens* [ibid., xi, p. 737], *O. nigrum*, and *O. rhodogenum*, but in a general way it may be concluded from these investigations that the moulds contaminating wood pulp are not of a destructive order.

McBride (J. S.). **Thirty-two years' experience with treated ties.**—*Railway Engin. & Maintenance*, xxviii, 2, pp. 111–112, 1932.

The preservation of sleepers was first carried out on a large scale by the Chicago and Eastern Illinois Railway in 1899. Burnettizing by zinc chloride [*R.A.M.*, viii, p. 4] has heen employed since 1906 and treatment with creosote oil since 1907. From 1907 to 1914 creosote and zinc chloride were used in about equal proportions, but during the war creosote became very scarce. Since 1924, however, it has been exclusively used and is now the standard preservative on the Railway [cf. ibid., xi, p. 685 and next abstract]. Most of the sleepers are of red oak [*Quercus rubra*] which is readily impregnated.

The average annual renewals during the past 15 years have been 4·09 per cent. of the total sleepers on the track, indicating an average life of 24·4 years, against an average life of 9·78 years in a test of 11,095 untreated sleepers established in 1918.

Van Ness (R. A.). **After fifty-seven years.**—*Railway Engin. & Maintenance*, xxviii, 5, pp. 329–331, 1 fig., 1932.

Constructional timber preservation was initiated on the Santa Fé Railway in 1875, when piles for the timber trestle bridge in Galveston Bay were treated with creosote [see preceding abstract]; some of these lasted for 20 years. The two oldest creosote-treated timber bridges on the railway were constructed in 1899 on the main line in Missouri, and it is estimated that the deck timbers of these are good for another 10 or 15 years. Practically all bridge timber now undergoes treatment. Between 1885 and 1931 the Santa Fé Railway impregnated some 300,134,000 board ft. of timber, of which 90 per cent. was for bridges, while during the same period about 14,700,000 linear ft. of piling was treated. Bridge timbers are now treated with an 8 lb. creosote mixture by the Rueping process [*R.A.M.*, xi, p. 815], southern pine [*Pinus palustris*, *P. taeda*, &c.] being impregnated with 14 lb. creosote per cu. ft. and Douglas fir [*Pseudotsuga taxifolia*] being treated to refusal (13 lb. with the aid of incision). Experiments are in progress with a 50-50 mixture of creosote and asphaltic or residue petroleum whereby all piling may be impregnated up to 18 lb. per cu. ft. This mixture is sufficiently toxic to wood-rotting fungi and the viscosity of the oil tends to retard the evaporation of the creosote. In order to prevent the decay of piling at the tops, the cut surfaces are sealed with creosote and heavy oil and the tops covered with two-ply roofing paper nailed down to the sides. Field holes in the timber, which were also found to be causing rot, are swabbed with hot creosote and a sealing compound.

Crosby (C. R.) & Chupp (C.). **The control of diseases and insects affecting vegetable crops.**—*Cornell Agric. Exper. Stat. Extens. Bull.* 206, 99 pp., 11 figs., 1931. [Received September, 1932.]

Practical directions are given in popular terms for the control of the principal diseases and pests of the following vegetables in New

York State: cabbage and related crops, beans, peas, spinach, beet, lettuce, cucurbits, onion, tomato, carrot, celery, asparagus, and sweet corn. Notes are also given on the control of some seed-bed diseases, and on the preparation of various insecticides and fungicides.

BURKHOLDER (W. H.) & CROSBY (C. R.). **Diseases, and insect and other pests, of the field Bean in New York.**—*Cornell Agric. Exper. Stat. Extens. Bull.* 58, 38 pp., 24 figs., 1932.

This revision of a bulletin published in 1923 contains popular notes on the symptoms, etiology, and control of the following bean [*Phaseolus vulgaris*] diseases in New York State: anthracnose (*Colletotrichum lindemuthianum*), to which the Nova Scotia and Perry Marrows, Wells's Red Kidney, and White Imperial have been found resistant [*R.A.M.*, xi, p. 618]; bacterial blight (*Phytomonas* [*Bacterium*] *phaseoli*) and other organisms [*Bact. flaccumfaciens*, *Bact. medicaginis* var. *phaseolicola*, *Bact. phaseoli* var. *fuscans*, *Bact. vignae* var. *leguminophila*, and *Bact. viridiflava*: ibid., ix, p. 695]; mosaic, commonly affecting the White Pea, Otenashi, Burlingame, and Blue Pod Medium varieties, White Marrow, Yellow Eye, and Kidney being less severely injured [ibid., xi, p. 499]; dry root rot (*Fusarium martii phaseoli*) [ibid., xi, p. 556], to which Yellow Eye is very susceptible, while a resistant non-commercial variety known as Flat Marrow has given promising results in hybridization trials; black root rot (*Thielavia basicola*) [ibid., iv, p. 136]; *Rhizoctonia* blotch; rust (*Uromyces appendiculatus*); and *Sclerotinia* rot (*S. libertiana*) [*S. sclerotiorum*].

KADOW (K. J.) & JONES (L. K.). **Fusarium wilt of Peas with special reference to dissemination.**—*Washington Agric. Exper. Stat. Bull.* 272, 30 pp., 4 pl. (1 map), 1932.

The wilt of peas caused by *Fusarium orthoceras* var. *pisi* is stated to be the most destructive disease at present occurring on this crop in the United States [*R.A.M.*, xi, p. 86]. Other hosts of the fungus are *Vicia gigantea*, a native perennial vetch from California and Nevada, and Sutton's New Giant broad bean (*V. faba*).

Temperature and the simultaneous presence of certain soil fungi, e.g., *Alternaria* and *Cladosporium* spp., appear to be the most important factors directly affecting the occurrence of wilt. Under western conditions the disease is prevalent at soil temperatures up to 88° F. The fungus is seed-borne. Dissemination is effected by farm implements and also by wind. The disease does not seem to cause appreciable damage until at least a year after its introduction into a field. Semesan seed treatment is ineffectual once the fungus has become established in the soil, though it inhibits infection by *F. martii* var. *pisi* and other secondary organisms. The use of such resistant varieties as Green Admiral, Horal, Prince of Wales, Senator, Bruce, First of All, Dwarf Telephone, and Giant Butter is the sole reliable means of avoiding wilt.

DOYER (L[UCIE] C.). **Möhrensamen.** [Carrot seed.]—*Nachricht. über Schädlingsbekämpf.*, vii, 3, pp. 107–109, 1 fig., 1932.

In this paper (which originally appeared in *De Veldbode*, Maastricht, 27th February, 1932), the writer draws attention to the frequent contamination of Dutch carrot seed by *Alternaria radicina* [*R.A.M.*, x, p. 327], good control of which, combined with increased germination, was given by disinfection with 0·25 per cent. uspulun, ceresan, or tillantin R.

**Mushroom-growing.**—*Min. of Agric. & Fish. Bull.* 34, 28 pp., 8 figs., 2nd edn., July, 1932.

This bulletin, first issued in October, 1931, and intended to replace the Ministry's leaflet No. 276 on 'Commercial Mushroom Cultivation', has been prepared with the co-operation of various experts, including W. M. Ware and W. F. Bewley. The section on cultivation comprises notes on different types of spawn (virgin, brick, and pure culture), the purchase of spawn, choice and preparation of manure, indoor and outdoor culture, making and management of beds, spawning, casing or soiling, and outdoor culture in pastures and the like. Notes are given on diseases and pests, including 'mushroom disease' or 'bubbles' (*Mycogone perniciosa*, *Cephalosporium costantinii*, and *Verticillium* sp.) [*R.A.M.*, xi, p. 493], 'gill mildew' or 'flock' (*C. lamellaecola* and *V.* sp.), brown blotch of the caps (*Pseudomonas tolaasii*) [ibid., xi, p. 764], plaster mould (*Oospora fimicola*), and the mushroom-bed *Sclerotium* (*Xylaria vaporaria*) [ibid., x, p. 8].

A 5-page bibliography is appended.

RAVAZ (L.). **Chronique. Mildiou—rot gris—rot brun.** [Current events. Mildew—grey rot—brown rot.]—*Prog. Agric. et Vitic.*, xcviii, 28, pp. 29–34, 1 col. pl., 1932.

Heavy rains on 19th and 20th June, 1932, were followed, as predicted by the Meteorological Station in Montpellier, on 26th and 27th of the same month by a severe invasion of all unsprayed vineyards in the south-west of France by *Plasmopara viticola* [*R.A.M.*, xi, p. 622]. This outbreak gives occasion to the author to stress once more the importance of spraying the vines not more than five days in advance of the date foretold for the threatened invasion, and to point out that the closer the spraying is made to that date the better the protection given to the vine. He also gives a brief description of the attack of the fungus on the grape bunches, causing grey rot when the flowers and fruit are infected, and brown rot when the rachis and peduncles are the first to be infected and the fruit has already reached a fair size. An interesting observation is that the presence of a thick cover of weeds in the vineyards tends to minimize the spread and development of the disease during the vegetative period of the vine, an effect which, in his opinion, is due to the desiccating action of the weeds on the soil and indirectly on the vines. After the end of vegetation, the weeds retard the maturation of the grapes and should be removed.

RAVAZ (L.). **Chronique. Toujours le mildiou.** [Current events. Mildew still.]—*Prog. Agric. et Vitic.*, xcviii, 29, pp. 53–56, 1932.

This is a brief review of the vine mildew [*Plasmopara viticola*] situation in France up to the early part of July, 1932. The disease is stated to have been very severe in the south and south-west, chiefly owing to the heavy rainfall that occurred about 20th June [see preceding abstract], and to show a marked tendency to spread eastwards; the more central and western provinces, however, suffered from the disease to a much lesser extent, some districts escaping entirely up to July.

RAVAZ (L.). **Chronique. Le mildiou. Les bouillies. Les cépages sensibles.** [Current events. Mildew. Sprays. Susceptible varieties.]—*Prog. Agric. et Vitic.*, xcviii, 30, pp. 77–83, 1932.

The author briefly describes the further progress of the 1932 epidemic of vine mildew [*Plasmopara viticola*: see preceding abstracts] in France, mainly owing to the frequent rains that fell at the beginning of July and caused fresh outbreaks of the fungus every two or three days. In many cases the lime used by the growers in the preparation of the sprays contained a high percentage of carbonate of lime, resulting in the very poor adhesiveness of the sprays. Notes are also given on the relative susceptibility to the disease of the different varieties of vine, indicating that while those with glabrous leaves appear to be less easily infected before spraying, presumably owing to the fact that the spores are retained to a lesser extent by smooth than by tomentose surfaces, the protection against infection by the sprays is more effective on the former than on the latter. Some details are finally given of the condition of the vineyards in the middle of July in different regions of France.

MANZONI (L.). **Relazione sul funzionamento degli osservatori antiperonosporici della provincia di Treviso. Annate 1930 e 1931.** [An account of the functioning of the anti-mildew forecasting stations in the province of Treviso. Years 1930 and 1931.]—Reprinted from *Annuario Staz. Sper. di Vitic. di Conegliano, 1929–1931,* iii, 2, 41 pp., 1932.

Reviewing the data supplied from 1929–31, inclusive, by the stations set up in the province of Treviso, Italy, to forecast attacks of vine mildew [*Plasmopara viticola*: cf. *R.A.M.*, ix, p. 762], the author states that the outstanding feature was that any given locality constantly showed the same relative degree of infection at any given date in one year as in the other two, although the prevailing weather, seasonal conditions, and the general severity of the disease were markedly different in the three years. The data provided by the various stations were not such as to account for this, and the slight differences in temperature and rainfall between the different localities could not be responsible for wide differences in the degree of infection. Really bad weather was, as a rule, experienced equally in all districts, while short, heavy, summer showers were usually most frequent in the hilly regions; these

however, do not predispose to mildew. If there was any correlation between temperature, rainfall, humidity, and infection at any one station, the same correlation either did not hold for the others, or was very much less apparent. The figures for the relative atmospheric humidity, especially the amount of dew, are those likely to show the greatest degree of error, either because of differences in the instruments at the various stations, or because the readings are taken at rather different times (in the evening, one hour may make a difference of over 20 per cent.) or because the stations face towards different points of the compass. The figure for the relative humidity, taken at sunset, approximates to the daily maximum, which frequently reaches 100 per cent. over the entire province, and tends to be very high near soil level, when the weather is fine and the wind light, even at high altitudes.

The practical utility of a forecasting station evidently does not depend upon any correlation between the data it supplies and those supplied by other stations.

It is concluded that while mildew forecasting stations are likely to be of service in certain parts of the province, they would be of little value in those areas where there is a constant tendency to infection even in dry seasons. In the last-named districts the number of spray applications given could still be considerably reduced without danger, though, owing to the prevailing economic conditions, the growers are now much less prodigal of their copper sulphate than formerly [cf. ibid., viii, p. 150].

VOSS. **Versuche mit Kupferkalk Wacker im Weinbau im Jahre 1931.** [Experiments with Wacker's copper-lime in viticulture in the year 1931.]—*Der Deutsche Weinbau, 1932,* 22, p. 174, 1932. [Abs. in *Neuh. auf dem Geb. des Pflanzensch., 1932,* 3–4, p. 93, 1932.]

Very good control of *Peronospora* [*Plasmopara viticola*] in the Trier [Treves, Rhine Province] vineyards was given in 1931 by Wacker's copper-lime [*R.A.M.*, x, p. 706] used at concentrations of 0·5 per cent. upwards, which proved fully equal to ordinary Bordeaux mixture in efficacy. For the present it is recommended to use the Wacker brand at a strength of 1 per cent. at the lowest.

MEYER (A.). **Recherches sur l'utilisation des matières colorantes organiques et de la 8-oxyquinoléine dans la lutte contre les maladies cryptogamiques de la Vigne.** [Researches in the utilization of organic dyes and 8-oxyquinoline for the control of cryptogamic diseases of the Vine.]—*Rev. de Vitic.*, lxxvii, 1991, pp. 117–120, 1932.

Brief details are given of continued experiments at the École de Viticulture de Beaune and by a small number of vine-growers in the Côte d'Or, to test the efficacy of organic dyes in the control of vine mildew [*Plasmopara viticola*: *R.A.M.*, xi, p. 622]. The investigation also included a copper salt of oxyquinoline, the preliminary results with which appear to be very promising. Of all the substances tested so far, oxyquinoline has been found to be the most effective under comparable conditions. The spreader used in

the tests was tibalène NAM at the concentration of 2 in 1,000, which experiments showed to be the best for practical purposes.

MARCHAL (P.) & FOËX (E.). **Rapport phytopathologique pour l'année 1931.** [Phytopathological report for the year 1931.] —*Ann. des Épiphyties*, xviii, 1, pp. 1–53, 1932.

This report on the phytopathological situation in France during 1931 is on the same lines as that for the previous year [*R.A.M.*, xi, p. 94] and contains, amongst others, the following items of interest apart from those already noticed from other sources.

*Puccinia glumarum* appeared on 27th March on wheat at Versailles, and owing to favourable weather conditions it had become very prevalent by 15th May. On 14th June *P. triticina* appeared on Alsatian wheat and attacked most of the other varieties so rapidly that by 17th June it was already becoming general. *P. graminis* appeared on 24th June, the attack becoming general on 8th July. A warm, dry period lasting from 20th June until 3rd July did not prevent attack by this rust. *Ophiobolus graminis* [ibid., xi, p. 503] was found on numerous wheat varieties in the vicinity of Paris, the attack being more important than that of 1930. *Cercosporella herpotrichoides* [loc. cit.], on the other hand, was less severe than in the previous year.

*Phytophthora infestans* was reported on potatoes in several localities in northern France in June and at Versailles on the 17th of that month. The outbreak was severe in the north. The fungus was also found at Versailles on tomatoes on 27th July and on eggplants on 25th August, by which time the disease had become extremely severe in the tomato plots, not one of the 22 varieties grown being resistant. Other species of *Solanum* affected in this locality included *S. caldasii*, *S. commersonii*, and *S. laciniatum*, the last-named being very severely attacked. *S. demissum* remained unaffected [cf. ibid, xi, p. 672].

*Gibberella saubinetii* was frequently noted on the débris of the previous years' hop vines; the young shoots from the same hills, however, remained perfectly healthy.

A detailed note is given on the situation as regards vine mildew (*Plasmopara viticola*) during the period under review, while shorter notes deal with diseases of trees, flowers, &c. Very numerous bibliographical references are given.

**Rapports sommaires sur les travaux accomplis dans les laboratoires en 1931.** [Summary reports on the work done in laboratories during 1931.]—*Ann. des Épiphyties*, xviii, 1, pp. 54–96, 1932.

Further investigations at Russ (Bas-Rhin) into wart disease of potatoes (*Synchytrium endobioticum*) showed that degeneration, whatever its nature, has no influence on the behaviour of potatoes towards the fungus. No evidence was obtained to show that seedlings from susceptible plants were immune while, on the other hand, several resistant varieties gave susceptible seedlings.

*Ascochyta rabiei* [*R.A.M.*, xi, p. 344] was ascertained to be strictly specific to chick pea (*Cicer arietinum*).

In further investigations into the different forms of die-back of

apricots present in the Rhone valley [ibid., xi, p. 791] made principally to ascertain the part played by the fungi most frequently found in the necrosed areas of the wood, artificial inoculations were carried out on apricots, almonds, peaches, and myrobolan and St. Julien plums, positive results being obtained on the first two hosts with a strain of *Verticillium dahliae* isolated from apricot. On almond the die-back was particularly rapid and the percentage of infection very high, while on apricot it progressed more slowly.

In 1931, immediately on the first appearance of potato blight (*Phytophthora infestans*) in the vicinity of Bordeaux about 15th July, the local forecasting station recommended growers to spray the plants with Bordeaux mixture. This application, effected during the second half of July or early in August, was highly efficacious, the half of one experimental field sprayed on 20th July being almost free from the disease on 15th September, when the untreated half was very severely infected.

**Phytopathologie.** [Phytopathology.]—*Rapport sur le fonctionnement de l'Inst. des Recherches Agron. pendant l'année 1931*, pp. 342–370, 1932.

Most of the numerous items of interest in this account of plant disease work in State-aided institutions in France in 1931 have already been noticed from other sources [see preceding abstracts, and also *R.A.M.*, x, p. 495; xi, pp. 344, 503, 550, 566, 735, 801, 807].

NARASIMHAN (M. J.). **Report of work done in the Mycological Section during 1930–31.**—*Admin. Rept. Agric. Dept. Mysore for the year 1930–31*, pp. 24–27, 1932.

In 1930–31 spraying for the control of areca [*Areca catechu*] koleroga [*Phytophthora arecae*: *R.A.M.*, xi, p. 509] was carried out over an area of 4,900 acres in Mysore, at a cost (for materials) of Rs. 16,900 [about £1,267].

Single spore cultures of the *Phytophthora* previously reported [ibid., x, p. 81] as isolated from jack [*Artocarpus integrifolia*] all developed oospores; the species thus appears to be homothallic.

'Anabe roga' disease of coco-nuts [*Ganoderma lucidum*: ibid., viii, p. 563], frequently confused with bleeding disease [*Thielaviopsis paradoxa*], is much more serious than the latter, and sooner or later kills the tree. In the early stages the lower green leaves droop, the crown narrows, and sometimes the foliage turns yellow.

Definite evidence was obtained that the organism causing black rot of coffee [*Corticium koleroga*: ibid., x, p. 239] at a certain stage in its life-history permeates the leaf tissue; bamboo in the surrounding jungle was also severely infected by this fungus.

In November 1930 potato fields in a locality where the Rickets variety is that most commonly cultivated were badly attacked by *Alternaria* [*solani*], considerable loss being sustained by the grower.

PARK (M.). **Report on the work of the Mycological Division.**—*Ceylon Administration Reports, Report of the Director of Agric. for 1931*, pp. D103–D111, 1932.

Heavy monsoon rains in Ceylon in 1931 favoured the spread of *Phytophthora palmivora* on *Hevea* rubber [*R.A.M.*, xi, p. 401]; most damage occurred in bud-wood nurseries and young clearings of budded rubber. Some estates reported a die-back of young *Hevea* shoots caused by the same fungus, a similar die-back being associated with *Gloeosporium albo-rubrum*, inoculations of artificially wounded shoots with which occasionally reproduced the condition.

Coco-nut palms growing in humid conditions were killed by bud rot due to *P. palmivora* [ibid., x, p. 594], this fungus being also found (for the first time in Ceylon) on *Carica papaya*, causing rotting of the fruits, stem, and collar.

Bacterial wilt (*Bacterium solanacearum*) attacked chillies [*Capsicum annum*: ibid., xi, p. 123], tomatoes, and potatoes; the first-named host also developing a disease referred to as 'little leaf' [cf. ibid., ix, p. 10].

Owing to the prompt eradication now general in Ceylon, bunchy top of plantains [ibid., x, p. 472] is causing less damage than formerly. Panama disease (*Fusarium cubense*) [*F. oxysporum cubense*] was recorded on plantains for the first time, the organism being isolated. There appeared to be marked differences in susceptibility amongst the varieties grown. Other diseases of plantains recorded included leaf spot (*Cercospora musae*), and a pseudostem infection associated with a *Fusarium*.

Mangoes were attacked by *Corticium salmonicolor* and by leaf diseases due to *Pestalozzia mangiferae* and *Cephaleuros parasiticus*. *Melanconium fructicolum* was found on pomegranate fruits and *Glomerella cingulata* on apples.

Ginger left too long in the ground was attacked by *Rhizoctonia* [*Corticium*] *solani*, the fungus injuring the leaves and rhizomes [cf. ibid., vii, p. 305].

A small experimental plot of Barbados 208 sugar-cane was attacked by sereh disease, the diagnosis being made by Dr. O. Postumus of Java.

Regular spraying with lime-sulphur markedly reduced citrus canker (*Pseudomonas citri*) [ibid., x, p. 786]. Mandarin types of orange are highly resistant, lemon less so, and most of the other citrus fruits grown are susceptible. Several instances of citrus gummosis were observed, two fatal attacks on grapefruit trees being attributed to a *Diplodia* closely resembling *D. natalensis*. A *Phytophthora*, probably *P. palmivora*, was recorded for the first time as causing, during wet weather, a die-back of young Washington Navel orange shoots; the pathogenicity of the organism was confirmed by inoculation.

Other new records [cf. ibid., xi, p. 223] included *Bacillus carotovorus* on carrot, *Fomes lucidus* [*Ganoderma lucidum*] on the roots of *Duranta plumieri* and *Gliricidia maculata*, *Helminthosporium* sp. and *Piricularia oryzae* on *Eleusine coracana*, *Peronospora* (?) *parasitica* on *Hibiscus esculentus*, *Sphaerostilbe repens* on the roots of *Poinciana regia*, and *Vermicularia zingiberae* [*Colletotrichum zingiberis*: ibid., xi, p. 545] on ginger.

**Forty-third Annual Report of the Indiana Agricultural Experiment Station for the year ending June 30, 1930.**—116 pp., 41 figs., 1 graph, 1930. [Received November, 1932.]

The following items of phytopathological interest occur in this report. Out of 734 wheat varieties from all parts of the world inoculated in the greenhouse with two physiologic forms of leaf [brown] rust [*Puccinia triticina*], 53 were found to show resistance. Out of a total of 135 selections resistant to the two physiologic forms 3 and 5, 48 showed resistance also to form 9 [*R.A.M.*, x, p. 363]. Selections of 69 wheat species and varieties were inoculated with four forms of brown rust, to all of which Warden, Vernal Emmer, Acme, and Buford proved resistant. Thirty-eight varieties and selections of spring and 167 of winter wheats were exposed to infection in field plots in various parts of Indiana and elsewhere, 15 of which gave marked evidence of resistance to *P. triticina*. In a three-rod row test of 179 rust-resistant selections, 39 gave yields above the control (37 bushels), while in an experiment with 72 resistant selections in twelve-rod rows, 14 showed an increase over the check. Among 44 collections of brown rust from nine States, physiologic forms 3, 5, 6, 9, 10 [ibid., v, p. 477], and four as yet undescribed were the most common. The varietal resistance of Webster to forms 3 and 5 was found to be inherited as a simple dominant factor. In the third generation of interspecific crosses the resistance of emmer wheat and of rye was shown to have been transferred to bread wheat types.

Of 25 Australian barley varieties inoculated with leaf [brown] rust [*P. anomala*: ibid., x, p. 230] two showed resistance to two physiologic forms common in the United States. In crosses between the two resistant and other varieties, resistance was found to be probably due to one main factor, usually dominant.

Sixteen out of 20 local rye selections also proved resistant to leaf [brown] rust [*P. secalina*], together with 3 out of 120 from Wisconsin, Minnesota, and Saskatchewan.

Bacterial wilt of maize [*Aplanobacter stewarti*: ibid., xi, p. 560] was extremely severe in the sweet corn trial plots at Lafayette in 1929, but some new hybrid strains of Golden Bantam, as well as Evergreen and Country Gentleman, showed a high degree of resistance to the parasite, which produced an average of 11 per cent. sterility in the best commercial strains of the first-named variety.

Out of 970 wheat varieties studied for their reaction to powdery mildew (*Erysiphe graminis*) [ibid., x, p. 718], 79 were highly resistant. The same was true of 39 out of 415 barley varieties, Arlington 110, Hanna 153, and Goldfoil 172 giving particularly satisfactory results. Five physiologic forms of powdery mildew have been differentiated on barley [ibid., x, p. 176]. In most of the crosses between resistant and susceptible barleys, resistance is inherited as a simple dominant factor. Nine of the 120 rye varieties and selections gave evidence of a high degree of resistance to powdery mildew.

Certain clover selections have shown resistance to *E. polygoni*, while others have been found resistant to anthracnose [*Kabatiella caulivora*: ibid., xii, p. 11].

Viruses have been collected from healthy potatoes and Jimson weed [*Datura stramonium*] which will combine with the tomato mosaic virus to produce streak [ibid., xi, p. 808]. When present alone in tomato, these viruses produce symptoms ranging from a very mild to a strongly marked mottling with necrotic spotting and burning. The potato virus constituent of the streak virus complex may be recovered by the inoculation of *D. stramonium*, seedling potatoes, or a variety of eggplant, in which tomato mosaic does not become systemic. Certain of the potato viruses withstood drying in diseased tissue for at least 16 days, and ageing in juice of diseased tomato and *D. stramonium* for two months. Apparently only one potato virus will combine with tomato mosaic to produce streak. One of the viruses found in all apparently healthy standard American potato varieties, but not in true seedlings unless by inoculation, produces necrosis in some seedlings, mottling in others, and no symptoms in a third group.

The Queen of the Market aster selections made in 1927 maintained their resistance to wilt [*Fusarium conglutinans* var. *callistephi*: ibid., xi, pp. 330, 746], while promising results were also given by a recent selection of Ostrich Feather.

**Report of the California Agricultural Experiment Station from July 1, 1930, to June 30, 1931.**—118 pp., 3 figs., 1932.

This report contains, in addition to items already noticed from other sources, the following references of phytopathological interest [cf. *R.A.M.*, xi, p. 161]. The identity of the organism responsible for the 'diamond canker' of French prunes [ibid., ix, p. 766] has not yet been established. Infection usually originates in wounds in the bark of the trees, which develop an abnormal thickening of the corky tissues; ultimately the whole cortex dies and the tree becomes stunted.

*Septoria rubi* has been found to attack the canes of the Cory Thornless blackberry [ibid., xi, p. 61] so severely as to render them unfruitful.

A species of *Dothiorella* growing in dead avocado twigs and leaf areas attacks the fruit as it softens in storage, causing superficial decay. A species of the same genus was further responsible for gummosis of *Cocos plumosa* trunks in Orange County; this host was also affected by a pinching of the crowns due to *Phomopsis* sp. The dull, black spots on the midribs and pinnae of *C. australis* leaves in San Diego County yielded a *Rosellinia*-like Ascomycete. *Fusarium* sp. was isolated from the dying leaf bases of *Phoenix reclinata*, from the blackened young central leaves of *Kentia*, and from streaks on the midribs of *P. canariensis*.

A study has been made of the effects on the proteoclastic enzymes of *Fusarium lycopersici*, of the root extracts of two strains of tomato, one resistant and the other susceptible to the wilt. Using liquefaction of gelatine and the production of amino acids from gelatine and 'bacto' beef as criteria, it was found that the extract from the resistant variety permitted more extensive liquefaction and a greater degree of protein hydrolysis.

Narcissus leaves are liable to attack by *Stagonospora curtisii* [ibid., xi, p. 786], the pathogenicity of which to *Hippeastrum* has

also been demonstrated. The fruit bodies of this organism in culture show the characters of *Phyllosticta*, a species of which is responsible for a red leaf spot of *Hippeastrum*. Studies on the relationship between these fungi are in progress.

STEYAERT (R. L.). **Rapport d'inspection phytopathologique des cultures de la Régie des Plantations de la Colonie (Rayon de Stanleyville).** [Report of the phytopathological crop inspection of the Administration of Plantations of the Colony (district of Stanleyville).]—*Bull. Agric. Congo Belge*, xxiii, 1, pp. 105–126, 14 figs., 1932.

Oil palms (*Elaeis guineensis*) in the Barumbu district are stated to suffer mainly from the trunk disease due to *Ganoderma applanatum* [*R.A.M.*, ix, p. 305], which has now been found to attack young as well as old trees. The examination of a young infected trunk failed to reveal the presence of the cavity usually regarded as typical of the disease, suggesting that this feature may be a consequence of secondary saprophytic invasion. The exodermis of the roots of infected palms was found to be friable, crumbling under pressure of the finger, and the vascular tissues were extensively penetrated by hyphae about 2 $\mu$ in thickness, while the medulla had disappeared. Rhizomorphs were absent, but fruiting sporophores protruded bracket-wise from the trunk. Before the removal of the sporophores they should be painted with carbolineum on the lower side in order to prevent spore dissemination during the process of detachment. The eradication and burning of diseased trees should be carried out with great care.

Cacao roots in the Likakula plantation were attacked by *Rigidoporus* (*Fomes*) *microporus* [*F. lignosus*: ibid., x, p. 80]. A branch canker, mainly involving the phloem tissues, is tentatively attributed to secondary fungous invasion following the insect *Sahlbergella singularis*. A white mycelium, 2 $\mu$ in thickness, was observed in the wood vessels, while a brown one, 4 $\mu$ in diameter, occupied the pith and medullary rays; the latter agrees with *Diplodia* [*Botryodiplodia*] *theobromae* [ibid., xi, pp. 26, 701], here acting evidently as a wound parasite. Three types of thread blight were distinguished on the aerial portions of cacao plants, viz., a *Corticium* type and two *Marasmioid* types (one with and the other without 'anker cells') [ibid., iv, p. 67], a key to the recognition of which is given. An unidentified species of *Colletotrichum*, characterized by uni- or biseptate setae, 117 to 234 $\mu$ long, slightly swollen at the base or in the middle, and cylindrical conidia, 22·5 to 35 by 5 to 8·75 $\mu$, caused the development on cacao pods of sunken, dark brown spots bearing the pink acervuli of the fungus.

*Hevea* rubber in Yangambi was attacked by *F. lignosus* [ibid., xii, p. 54], while the partial cessation of the latex flow in one tree was found to be a result of brown bast [ibid., x, p. 620].

*F. lignosus* is the most dangerous parasite of coffee in the Lula plantations [ibid., ix, p. 177]. *Coffea klainii*, which is grown in a separate plot at the edge of the forest, was affected by a disease characterized by the presence on the roots of dendroid, spongy tumours, ranging from the size of a small nut to that of an egg

[see below, p. 91]. Sections through the tumours showed that they consisted of several layers, the outermost being composed of flat, yellowish cells measuring about 20 by 10 by 16 $\mu$, the second of larger, elongated elements, and the innermost of more spherical cells, about 40 to 108 by 28 to 60 $\mu$, containing masses of pale yellowish-brown granules. On staining a crushed preparation of the granular material with Ziehl-Neelsen's reagent, bacteriform bodies were detected, slightly tinged with blue, measuring 2·18 to 4·35 by 0·87 to 1·16 $\mu$. Affected trees lost their leaves or appeared to be suffering from drought. The disease, which has also been observed on *C. robusta*, is of sufficient importance to warrant further investigations.

BRYAN (MARY K.). **Color variations in bacterial plant pathogens.** —*Phytopath.*, xxii, 9, pp. 787–788, 1932.

Similar white variants to that of *Aplanobacter michiganense* described in 1930 [*R.A.M.*, x, p. 415] have been observed in old beef agar cultures of *Bacterium campestre* [*Pseudomonas campestris*], *Bact. vesicatorium* [ibid., xi, pp. 803, 804], and *Bact. cucurbitae* [ibid., x, p. 639]. In *Bact. vesicatorium* the white strain was also isolated directly from typically spotted fruit from Mexico. Inoculation tests showed that the white variants of *Bact. vesicatorium* and *P. campestris* were as virulent as the normal yellow strains, which was not the case, however, with *Bact. cucurbitae*. In all three strains the white character persists in various culture media, reversion to yellow having occurred only in an occasional culture kept in a refrigerator for months. *A. michiganense* also produces a pink strain.

SCHÄTZEL (K.). **Beiträge zur Morphologie und Physiologie des bakteriellen Pflanzenkrebserregers.** [Contributions to the morphology and physiology of the bacterial plant cancer organism.]—*Phytopath. Zeitschr.*, v, 3, pp. 251–273, 1932.

No evidence was obtained in the author's studies on the morphology and physiology of *Pseudomonas* [*Bacterium*] *tumefaciens* that the 'rosette' or 'star' phase of the life-cycle represents a sexual process as suggested by various writers [*R.A.M.*, xi, p. 357]. It appears usually in the skin formed on the surface in liquid media and is, perhaps, concerned in the aeration of the latter. No proof was forthcoming, moreover, of the presence of filterable, ultramicroscopic gonidia as observed by Lieske [ibid., vii, p. 705]. The filters used were of porcelain, kieselguhr (Berkefeld N), and asbestos (Seitz E.K.), the last of which allowed the unaltered bacteria to pass in some of the tests. Filtration through membrane filters of pore size of 1 $\mu$ or less was also unsuccessful. Successful inoculation experiments on *Helianthus annuus* and *Nerium oleander* indicated that the strains under study were normal virulent strains. Tumour formation was further induced in *Euphorbia helioscopia*, but as no latex tubes were involved it was impossible to verify Lieske's hypothesis regarding the dissemination of infection within this plant by means of the latex.

RIVERA (V.). **Secondo contributo alla conoscenza della influenza dell'energia raggiante ambientale sull'accrescimento di piante terrestri e di neoplasmi vegetali.** [A second contribution to the knowledge of the influence of ambiental radiating energy on the growth of terrestrial plants and plant neoplasms.]—Reprinted from *Riv. di Biol.*, xiii, 1–6, 87 pp., 12 figs., 1931.

Continuing his earlier investigations [*R.A.M.*, x, p. 709], with special reference to the influence of ambient radiation, the author conducted an extensive series of experiments [which are fully described and the results of which are discussed in detail] in which *Pelargonium* plants inoculated with *Bacterium tumefaciens* were placed for periods ranging from 8 to 38 days in various types of containers differing in their resistance to the penetrating (especially the cosmic) rays of the atmosphere.

Plants kept in containers made of one thickness of lead developed large neoplasms, usually bearing aerial roots; the whole plant, or the shoot bearing the tumour, if mature plants were used, wilted. Further inoculations of etiolated tissues on these plants gave negative results, or produced very small, ill-developed neoplasms.

Plants kept in wooden containers showed a very slow neoplastic growth and never wilted, any wilt, even of the shoot bearing the tumour, if it did occur, taking place only after a long time. Further inoculations of the etiolated tissues gave rise to well-defined neoplasms.

Plants kept in lead boxes lined with paper or in double-walled lead containers rapidly developed large neoplasms, sometimes with aerial roots, but continued to live for a longer or a shorter period. Inoculations of etiolated tissues gave fairly well-developed neoplasms.

The author concludes that the containers made of one thickness of lead induced a considerable acceleration in the growth of the normal shoots and also excited to the highest degree the formation of neoplastic tissue. In the wooden containers the disease developed very slowly, and the plant appeared to be unharmed by the presence of the tumour. The remaining types of container, which included lead lined with paper or glass and wood lined with glass, gave results intermediate between these two. Ultra-penetrating radiation is considered to retard cellular multiplication.

RIVERA (V.). **Radiazione ambiente ed accrescimento nei vegetali.** [Ambiental radiation in relation to plant growth.]—Reprinted from *Riv. di Biol.*, xiii, 1–6, 40 pp., 1931.

After summarizing and discussing the results obtained in his earlier investigations into the effect of radiation upon normal and abnormal plant tissues [cf. *R.A.M.*, ix, p. 25 and preceding abstract] the author describes an experiment in which a geranium plant bearing a tumour resulting from an artificial inoculation with *Bacterium tumefaciens* effected on 16th March, 1929, was, on 6th July, freshly inoculated with the same organism at the tip of the branch carrying the tumour and a few moments later exposed to the long Hertzian waves below the infra-red, the wave-length used being 2 m. at 40 watts oscillation. The plant was exposed

for about 100 hours, spread over 12 days, each twelve hours of exposure being followed by at least twelve hours' rest. The oscillation used produced an electro-magnetic wave of about 12·3 m., and the inoculated branch was placed at a distance of about 10 cm. away. A control plant, exactly similar, and inoculated in exactly the same manner on the same dates, remained 10 or 12 m. away, separated from the apparatus by two walls.

Four days after exposure was begun the branch bearing the old tumour, as well as the old tumour itself, ceased to grow, while the new tumour continued to make marked growth. The new neoplasm developing on the control plant grew more slowly. The inoculated shoot and the neoplasms then gradually died, while the control plant remained green and produced a very large tumour which was still alive on 15th February, 1930.

The author considers that the stimulation to the growth of the tumour given by the exposure was directly responsible for the death of the shoot, the increased need for food material on the part of the tumour rapidly exhausting and finally killing the branch.

THOMAS (J. A.). **Contribution à l'étude des réactions de quelques invertébrés à l'inoculation de substances à propriétés cancérigènes et du Bacterium tumefaciens.** [A contribution to the study of the reactions of some invertebrates to inoculation with substances of cancer-inducing properties and with *Bacterium tumefaciens.*]—*Ann. Inst. Pasteur*, xlix, 2, pp. 234–274, 16 figs., 1932.

This is a considerably expanded account of the writer's investigations on the reactions of various invertebrates to inoculation with *Bacterium tumefaciens* [*R.A.M.*, xi, p. 227], the following additional information on which may be mentioned. The inoculation of cancer-inducing substances, such as arsenate of soda, indol, or coal-tar into *Ascidia mentula* and *Nereis diversicolor* provoked only slight inflammatory reaction in contrast to the fatal results induced by *Bact. tumefaciens.* Another Gephyrean, *Phascolosoma vulgare*, reacted similarly to *Sipunculus nudus* [loc. cit.] on inoculation with the bacterium, which developed well in culture in the blood of this worm kept under sterile conditions *in vitro.*

SANFORD (G. B.) & BROADFOOT (W. C.). **Epidemiology of stripe rust in Western Canada.**—*Scient. Agric.*, xiii, 2, pp. 77–96, 3 maps, 1 graph, 1932. [French summary, p. 131.]

This paper gives an outline, based on four years' observations, of the prevalence, distribution, and host range of stripe [yellow] rust (*Puccinia glumarum*) of wheat in Canada, with particular reference to Alberta [cf. *R.A.M.*, viii, p. 492]. Each year the rust appeared first (in July) in the south of this province, usually on *Hordeum jubatum* in low-lying places, whence during late August it gained the uplands and spread to central Alberta towards the middle of September, the general trend of dispersion being northwards. There was distinct evidence that the yellow rust rarely persists through the winter in the uredo stage in Canada. Only two cases of its overwintering in this stage on autumn-sown wheat were observed; in one case it failed to become established on the

new foliage, and in the other, although some of the new leaves were slightly attacked in the spring, the rust soon disappeared as these leaves died. There was no evidence of its persistence from season to season in the form of dormant mycelium.

The investigation suggested that the annual reappearance of yellow rust in Alberta is due to wind-borne spores coming during June or early July from the States of Washington, Idaho, and possibly Montana, but not from southern British Columbia. It is believed that the late and slow development of the rust in central Alberta may be explained chiefly by the action of adverse winds which hinder the spread of the infection from the south, and that in certain parts of the province the check to the development of the rust is caused by deficient rainfall rather than by differences in temperature during August and September.

The scarcity of the yellow rust in central Saskatchewan may find a better explanation in the lack of sufficient inoculum coming from Alberta at the critical time for infection, than on the basis of temperature or of lack of susceptible hosts.

BECKER (K. S.). **Die amtlich empfohlenen Beizmittel nach dem Stande vom Herbst 1932.** [The status of the officially recommended disinfectants in the autumn of 1932.]—*Deutsche Landw. Presse*, lix, 39, p. 491, 1932.

A table is given showing the various fungicides officially recommended by the German Plant Protection Service for the control of seed-borne cereal diseases, together with the appropriate rates of application and duration of treatment. Ceresan is the only dust recognized as effective against the four principal diseases of this nature, viz., wheat bunt [*Tilletia caries* and *T. foetens*], snow mould of rye [*Calonectria graminicola*], barley stripe [*Helminthosporium gramineum*], and loose smut of oats [*Ustilago avenae*] at the rate of 200, 200, 300, and 500 gm. per doppelzentner of seed-grain, respectively. Liquid treatments effective against all four diseases are ceresan liquid U. 564 (30 minutes' immersion at 0·1 per cent. for wheat, rye, and barley, 0·2 per cent. for oats), germisan (15 minutes at 0·125 per cent. for wheat, 30 minutes at 0·125 per cent. for rye, one hour at 0·125 per cent. for barley, and 30 minutes at 0·25 per cent. for oats), and uspulun-universal (30 minutes at 0·2 per cent. for wheat and rye, one hour at 0·25 per cent. for barley and oats). Ceresan U. 564 and germisan may also be applied by the short disinfection process [*R.A.M.*, xi, p. 502] at the following rates: ceresan, 3 l. at 2, 1·75, and 2·5 per cent., respectively, for wheat, rye, and barley, and 4 l. at 3·5 per cent. for oats; germisan, 4 l. at 1 or 3 l. at 2 per cent. for wheat, 3 l. at 1·75 per cent. for rye, 3 l. at 2·5 per cent. for barley, and 4 l. at 3·5 per cent. for oats.

BRIGGS (F. N.). **Inheritance of resistance to bunt, Tilletia tritici, in hybrids of White Federation and Odessa Wheat.**—*Journ. Agric. Res.*, xlv, 8, pp. 501–505, 1 graph, 1932.

The result of further experiments [conducted on the same lines as the previous work: *R.A.M.*, xi, p. 500] on the inheritance in wheat of resistance to bunt (*Tilletia tritici*) [*T. caries*], in which the $F_2$ and $F_3$ generations of crosses between the susceptible White

Federation and the resistant Odessa were tested for resistance, showed that Odessa differs from White Federation in one dominant factor for resistance. It was also shown that this factor, as well as the factor for resistance in White Odessa [ibid., ix, p. 515], is identical with the factor in Martin [loc. cit.]. The constitution of these two wheats, like Martin and Banner Berkeley, may be designated MMhh. The proper designation for Turkey 1558 and Turkey 3055 [ibid., xi, p. 500] has not yet been determined, but they each contain a single factor for resistance which is similar in effect to the second Hussar factor HH.

CHURCHWARD (J. G.). **Inheritance of resistance to bunt, Tilletia tritici (Bjerk.) Winter, and other characters in certain crosses of 'Florence' Wheat.**—*Proc. Linn. Soc. New South Wales*, lvii, 3–4, pp. 133–147, 4 graphs, 1932.

The results of further work in New South Wales on the genetics of resistance in wheat to bunt (*Tilletia tritici*) [*T. caries*: *R.A.M.*, xi, p. 99] showed that in the $F_3$ generation of all the crosses between the resistant Florence and four susceptible commercial Australian varieties, namely, Firbank, Gullen, Yandilla King, and Marshall's No. 3, the three classes, homozygous susceptible, heterozygous susceptible, and homozygous resistant, gave an approximation to a ratio of 1 : 2 : 1, and indicated the presence of a single factor difference with dominance of susceptibility, as in the Florence × Hard Federation cross [loc. cit.]. In the Florence × Gullen cross there was evidence that inheritance of resistance to bunt is independent of the inheritance of colour of chaff.

MANNOZZI TORINI (L.). **Influence des produits d'excrétion des champignons du sol sur le développement du Blé.** [The influence of the products of excretion of soil-inhabiting fungi upon the growth of Wheat.]—*Boll. Sez. Ital. della Soc. Internaz. Microbiol.*, iv, 9, pp. 244–248, 1932.

Some 40 species of soil-inhabiting fungi obtained from various types of agricultural lands (a few being strong facultative parasites, but most of them common saprophytes) were grown on carrot broth for one and a half months at laboratory temperature. The culture liquid in which each fungus had been grown was filtered off aseptically, 20 c.c. of the filtrate being placed in a Petri dish 15 cm. in diameter and containing three sterilized paper filter discs. Ten carefully chosen wheat seeds sterilized with uspulun (2·5 per 1,000) and rinsed in sterilized water were then placed in each dish. Two Petri dishes containing sterilized carrot broth and two containing sterilized water were used for control purposes. On the twentieth day after germination the length of the roots and aerial part of the seedlings was measured.

The fungi tested, as regards the effects of their products of excretion, fell into three groups. There were 25 species whose excretions reduced the length of the roots and the aerial parts. They included four species of *Trichoderma*, *Aspergillus niger*, *Cunninghamella* sp., *Rhizoctonia* sp., *Cephalosporium* sp., *Rhizopus nigricans* [*R.A.M.*, xi, p. 389], and *Botrytis cinerea*. A further 10 species reduced the length of the roots, but had no apparent deleterious effect on the aerial parts. The products of

the remainder appeared to exercise no appreciable effect at all; these comprised *Mucor* sp., *Mortierella* sp., *Fusarium* sp., *Cephalosporium* sp., and *Absidia spinosa.*

The culture liquids from the first group, and to a less extent those from the second, produced various pathological changes in the roots which, in the case of the more toxic species, were not only rapidly killed, but underwent partial or complete dissociation of the tissues.

Further experiments demonstrated that the soil absorbs completely (so that filtration through soil removes them) or in part the excretory products released by soil-inhabiting fungi. Some of the harmful products thus absorbed injure seedlings sown in the soil and are evidently in a form accessible to the roots; others cause no injury and hence, though present, are evidently not in a form that can be taken up by the plant.

COTTER (R. U.). **A new form of Oat stem rust from a Barberry area.**—*Phytopath.*, xxii, 9, pp. 788–789, 1932.

A new physiologic form, designated form 10 [cf. *R.A.M.*, iii, p. 22; xi, pp. 362, 437], of oat stem rust (*Puccinia graminis avenae*) was identified in two collections from a barberry area in Wisconsin, in 1930. Both collections have been cultured in the greenhouse for over eight months and have behaved consistently on the differential oat varieties. Form 10 attacks Richland (C.I. 787), which is resistant to 1, 3, 7, 2, and 5, the most prevalent forms of oat stem rust in the United States. While forms 4 and 6 also infect Richland heavily, White Tartar (C.I. 551) is very susceptible to these, but resistant to 10, and Joanette Strain (C.I. 2660), resistant to 4 and susceptible to 6, reacts indeterminately to form 10, the infection type (X) [ibid., ii, p. 159] being similar to that induced on this variety by form 5. It is suggested that the new form originated by hybridization on the barberry.

RADEMACHER (B.). **Praktische Möglichkeiten zur Verhütung und Bekämpfung der Urbarmachungskrankheit.** [Practical possibilities for the prevention and control of the reclamation disease.]—*Fortschr. der Landw.*, vii, 18, pp. 457–460, 3 figs., 1932.

Continuing his investigations on the reclamation disease of cereals in Schleswig-Holstein [*R.A.M.*, x, p. 489], the writer draws attention to the prevalence of illness among livestock pastured on the affected areas.

A number of figures are given showing the beneficial effects of copper sulphate and other copper-containing preparations on the yield of crops suffering from the disease [ibid., xi, p. 768].

It was shown by a pot test on Lochow's yellow oats that the remedial effects of copper sulphate and nitrate are greatly increased by direct application to the foliage instead of through the soil (17 and 17·55 gm. of seed-grain, average from two pots, for copper sulphate and copper nitrate, respectively, for the former compared with 6·85 and 5·35 gm. for the latter method).

A study of the varietal reaction of oats to the disease showed that most of the standard sorts are liable to more or less severe

injury, among them several of the Swedish Svalöfs, and a number of other well-known varieties [which are listed]; the Rotenburger Black, Black President (Dutch), and Black Mesdag (U.S.A.), however, are resistant (also to grey speck) and should be more widely cultivated. A comparative test in 1931 indicated that better results may be expected on affected soils from a resistant, relatively low yielding variety (Black President) without treatment than from a prolific sort (Svalöf's Victory) receiving copper sulphate (156 kg. per hect.). The yield of the treated plot of the latter was 672·8 kg. per hect. compared with 94·4 kg. for the control, the corresponding figures for Black President being 1846·2 and 1453·9 kg. per hect. Hanna barleys are highly susceptible, while Pflug's Intensiv and Extensiv are fairly resistant.

COTTER (R. U.) & LEVINE (M. N.). **Physiologic specialization in Puccinia graminis secalis.**—*Journ. Agric. Res.*, xlv, 5, pp. 297–315, 1 fig., 1 map, 2 graphs, 1932.

This is a summarized account of the results obtained in the study from 1921 to 1931 of 147 collections of rye stem [black] rust (*Puccinia graminis secalis*) [*R.A.M.*, x, p. 365], mainly from the rye-growing districts of the United States, on five differential varieties of rye [a brief botanical description of which is given]. Fourteen different physiological forms of the rust were determined, the geographical distribution, characteristic reaction on the differential hosts, and pathogenicity of which are indicated in tables. Attention is called to the special technique which has been necessary for the identification of the forms, owing to the fact that rye is cross-pollinated, but apparently the results are no less certain than in the case of the rusts of wheat or oats.

Form 11 was isolated from the largest number of localities, and was markedly predominant in the epidemics of 1926, 1927, 1929, and 1931. Form 7 was collected almost as often as the former; it appeared to be scattered over a greater geographical area, but did not occur in as many years though it was especially common in 1927. The remaining forms were only collected occasionally. Collections of forms 2 and 4 were also received from France, and form 11 from Scotland.

The frequency of the occurrence of the physiological forms was not always co-extensive with their distribution, nor was the prevalence of a given form paralleled by its virulence on the differential hosts. The pathogenicity of the forms was but slightly and only temporarily affected by environmental conditions, e.g., temperature and light. There was strong circumstantial evidence of the occurrence of colour mutations, but none of mutations in parasitic behaviour. The fact that new forms of wheat black rust (*P. graminis tritici*) were produced by crossing it with *P. g. secalis* is considered to support the possibility of the origin in nature of new forms of black rust on rye through hybridization.

DIXON (S.). **The relation of food to disease.**—*Journ. Soc. Chem. Ind.*, li, 39, pp. 787–795; 40, pp. 808–813, 1 diag., 1932.

In connexion with a survey of the history and etiology of various forms of food poisoning, the writer gives a brief account

of ergotism due to the consumption of bread made from rye infected by *Claviceps purpurea* [*R.A.M.*, xi, p. 445]. Recent work by E. Mellanby indicates that lack of vitamin A, together with the presence of some constituent of ergot other than ergotoxin, is responsible for the convulsive form of the disease, while ergotoxin causes gangrene. It is estimated that in the Russian outbreak of 1926 [ibid., viii, p. 304] at least 11,000 persons were affected (some fatally), chiefly by nervous symptoms. The proportion of ergot in the rye ranged from 1 to 26·7 per cent. by weight in different districts, the disease occurring when 1 per cent. was present and proving fatal with 7 per cent. As a result of this epidemic the U.S.S.R. fixed a limit of 0·15 per cent. for the amount of ergot regarded as permissible in flour, the corresponding allowance in Germany being 0·1 per cent. In the mild epidemic among Jewish immigrants in England following the wet summer of 1927 [ibid., vii, p. 505], the grain from which the rye meal was prepared yielded 0·9 per cent. of ergot by hand picking, while colorimetric analysis showed 1·5 per cent., equivalent to between 0·18 and 0·3 per cent. in the flour.

BAUCH (R.). **Über die genetischen Grundlagen von Zwittrigkeit und neutralem Verhalten bei Brandpilzen.** [On the genetic bases of hybridization and neutral behaviour in smut fungi.] —*Planta*, xvii, 3, pp. 612–640, 1932.

A comprehensive account is given of the writer's continued studies on the genetics of the smut fungi, from which it appears that, in *Ustilago longissima* [*R.A.M.*, xi, p. 569; xii, p. 17], both hybrid and 'neutral' or sterile strains (i.e., those giving no evidence of sexual reactions) occur among the progeny of spores of a known genetic constitution. The segregation of dioecious haplonts of these strains was found to depend on the distribution of the chromosomes bearing the factors responsible, respectively, for normal reproduction and 'neutrality'. The development of 'solopathogenic' strains of maize smut (*U. zeae*) [loc. cit. and next abstract] seems also to depend on similar chromosomal aberrations to those occurring in *U. longissima*.

BAUCH (R.). **Die Sexualität von Ustilago scorzonerae und Ustilago zeae.** [The sexuality of *Ustilago scorzonerae* and *Ustilago zeae*.]—*Phytopath. Zeitschr.*, v, 3, pp. 315–321, 4 figs., 1932.

The author applied the technique already found successful with *Ustilago longissima* and *Sphacelotheca schweinfurthiana* to induce sporidial fusion in *U. scorzonerae* (a destructive parasite of *Scorzonera humilis* in north Germany) and the maize smut (*U. zeae*) [see preceding abstract]. In the latter, as in *U. longissima*, exploratory hyphae and 'tangle fusions' [*R.A.M.*, xi, p. 569] were detected, and the fungus was found to have more than two types of sex, giving a typical picture of multipolar sexuality, while *U. scorzonerae* is bipolar. The best differentiation of the sexual behaviour of combinations of single-sporidial cultures were obtained with young (one-day-old) colonies at a temperature range of 20° to 30°C. Multipolar sexuality depends on the existence of two

groups of factors, one group consisting of sex factors in the narrow sense, a combination of any two of which permits of full sexual reaction, while the other consists of sterility factors, the combination of two identical factors of this group giving rise to exploratory hyphae and tangles which cannot infect the host or produce smut spores. Six sterility and two sexuality factors were found to be involved among one hundred isolations of monosporidial strains of *U. zeae*. A table is given showing the reactions of ten haplont types of maize smut.

RODENHISER (H. A.). **Heterothallism and hybridization in Sphacelotheca sorghi and S. cruenta.**—*Journ. Agric. Res.*, xlv, 5, pp. 287–296, 3 pl., 5 diags., 1932.

Heterothallism in *Sphacelotheca sorghi* [*R.A.M.*, xi, p. 448] and *S. cruenta* [ibid., xi, p. 235] is stated to have been established in the experiments reported in some detail in this paper, by the fact that inoculation of Reed kafir sorghum, which is susceptible to both species, with a monosporidial culture of either failed to produce infection, while infection resulted and smutted heads and spores were produced when the plants were inoculated with two monosporidial lines in certain combinations. So far only two opposite sex groups have been determined in the two species, which were shown by crossing to be interfertile; the sex groups remained constant both in the inter- and in intraspecific crosses. The factors determining sex in monosporidial lines of both species segregated on a 2 : 2 and a 1 : 3 basis, and appeared to be independent of those determining type of growth on artificial media [cf. ibid., xi, p. 446].

Intraspecific crosses produced sori in the host panicles that were macroscopically typical of the species, while in interspecific crosses the sori produced were predominantly characteristic of *S. cruenta*. Both the elongated and the spherical hyaline sterile cells, which are usually considered to be, respectively, typical of *S. sorghi* and *S. cruenta*, were present in both the intra- and the interspecific crosses, indicating that this feature has no taxonomic significance.

There was some evidence that the sexual compatibility of paired monosporidial lines may be detected soon after inoculation, as when the plants were inoculated with sexually compatible lines distinct chlorotic areas developed, while plants inoculated with monosporidial or sexually incompatible lines remained normal.

FAWCETT (H. S.). **New angles on treatment of bark diseases of Citrus.**—*California Citrograph*, xvii, 10, pp. 406–408, 1932.

In this paper the author gives a popular account of the conditions that favour the development of the principal bark diseases of citrus trees in California, namely, psorosis [*R.A.M.*, xi, pp. 367, 770], decorticosis (shell bark) of lemon trees (*Phomopsis californica*) [ibid., x, p. 98], and brown rot gummosis (*Phytophthora citrophthora*) [ibid., xi, p. 779], and also of the measures for their prevention and treatment.

Two types of psorosis seem to occur, a common one ('psorosis A') with roughening and scaling of the bark at an early stage, while gum production is scanty, and a second ('psorosis B') in which a quantity of gum oozes out while the bark is still alive and

shows no scaling. This last type spreads very rapidly on the stem and does not yield to early treatment as readily as psorosis A. The treatment by scraping and the application of a suitable fungicide to the scraped surface is still the best, and is equally effective against lemon decorticosis. The application of powdered Bordeaux mixture to the soil around the collar and main roots and painting the trunks with a thin Bordeaux wash are useful in preventing gummosis due to *P. citrophthora*.

Reichert (I.) & Perlberger (J.). **Little leaf disease of Citrus trees and its causes. (Preliminary note.)**—Reprinted from *Hadar*, iv, 8, 6 pp., 1931. [Received October, 1932.]

In the summer of 1928 the little leaf disease of citrus [*R.A.M.*, x, p. 307] was severe in Palestine. The affected oranges showed abnormally heavy and premature flowering with malformation of the fruits. Buds from diseased trees produced diseased individuals in their turn.

No organism could be detected in the affected trees and attention was therefore directed towards other factors likely to be responsible. The rainfall in the Jaffa district during the winter of 1927–8 was only 418 mm., compared with 442 to 729 mm. during the previous eight years. The potassium content of the ash of abnormal leaves, moreover, was only 8·27 to 8·92 per cent. as against 11·58 to 12·80 per cent. for healthy ones. Potassium is known to increase the water-holding capacity both of the soil and of the plant. The sap concentration of leaves from diseased trees budded on sour orange (*Citrus bigaradia*) stocks was found to be 23·8 to 23·9 per cent., compared with 20·2 to 20·6 per cent. in normal ones, the corresponding figures for those on sweet lime (*C. limetta*) being 21·4 to 21·5 and 15·8 to 16 per cent., respectively. The xeromorphic nature of little leaf is thus considered to be established.

[Smith (F. E. V.).] **Coconut disease in St. Mary.**—*Journ. Jamaica Agric. Soc.*, xxxvi, 9, pp. 448–452, 1932.

Two forms of bronze leaf wilt of coco-nut palms [*R.A.M.*, ix, p. 238] are now present in Jamaica, in one of which the circle of leaves round the bud (but not including the youngest central ones) turns yellow, then ashen-grey, and dies, many of the leaf stalks showing brown streaks and cracks from which gum oozes. In the other form, present in clay soils, the same part of the tree is affected, but the leaves turn dark brown or bronze. Both forms of the disease have a common origin, and though they are associated with secondary fungi, these are organisms that are present on coco-nut palms everywhere, and are not the cause of the trouble. The locality most recently affected in Jamaica has suffered from a series of droughts at exceptional times, and these have been followed during the last two years by two and a half times the normal rainfall; here the disease is confined almost entirely to the hill slopes where the soil is a heavy clay, and is, in the author's opinion, due to the heavy rainfall.

A very similar situation existed in the same districts in 1911 and 1912, when, however, it was less apparent as there were fewer

coco-nuts grown. Where the palms are growing in heavy soil bronze leaf is rife, but with proper cultivation and drainage it can be reduced to insignificance. The author considers that the forms of wilt under discussion affect only trees weakened by abnormal weather conditions and grown in unsuitable soil.

STEYAERT (R. L.). **Une épiphytie bactérienne des racines de Coffea robusta et C. klainii.** [A bacterial epiphyte of the roots of *Coffea robusta* and *C. klainii*.]—*Rev. Zool. Bot. Afr.*, xxii, 2, pp. 133–139, 2 pl., 1932.

An account is given of the tumours on the roots of coffee (*Coffea robusta* and *C. klainii*) in the Lula plantations, Stanleyville, Belgian Congo [see above, p. 81]. In general appearance the more or less spherical, light brown nodules resemble those found in other countries on alder [*R.A.M.*, x, p. 476], but the coffee tumours are paler and more fragile. The internal structure of the two types of nodule is also closely similar. The organism isolated from the coffee tumours, to which the name *Bacillus coffeicola* n. sp. is given, stains well with basic fuchsin. Like *B. radicicola* [ibid., xi, p. 592], the coffee pathogen contains one or more chromatic centres and is capable of assuming Y or T shapes, so that the two are evidently closely related. *B. coffeicola* is non-acid-resistant and non-flagellate.

MALLAMAIRE (A.). **Sur une maladie du Caféier à la Côte d'Ivoire.** [On a disease of Coffee on the Ivory Coast.]—*Agron. Colon.*, xxi, 174, pp. 193–197, 1932.

Five-year-old *Coffea liberica* trees and to a less extent the Gros Indénié variety in the Lower Ivory Coast became attacked in 1930, and to a progressively greater extent in the two succeeding years, by a severe form of apoplexy in which the bushes died before the leaves had time to turn yellow or fall. No lesions were present on the aerial parts, but the larger roots bore flattened, yellowish-white strands, the outer part of which consisted of yellow, septate hyphae, 3 to 4·5 $\mu$ in diameter, and with numerous clamp-connexions. Inside these were hyaline filaments of about the same diameter. The fungus is thought to be possibly *Fomes lignosus* [see above, p. 80].

Control consists in uprooting and burning the diseased trees, encircling affected areas with a trench, and adopting sanitary precautions such as liming the soil, improving drainage, and removing all fallen trees and stumps [cf. *R.A.M.*, xii, p. 54].

HEWISON (R.). **Blackarm in the Gezira, season 1931–32.**—*Empire Cotton Growing Review*, ix, 4, pp. 276–284, 1932.

This report embodies the author's observations on the incidence and development of the blackarm disease (*Bacterium malvacearum*) of cotton [*R.A.M.*, xi, p. 450] in the Gezira during the 1931–2 season, in the attempt to throw some light on the still obscure points in the life-history of the organism. The bulk of the seed used (which was sown at a later date than usual, namely, between 10th and 31st August) was freshly imported from Egypt and was disinfected with abavit B, with the result that no primary infection

of the cotyledons was observed in the seedlings. In the areas, however, that were sown before or at the time of the rains which occurred on 21st and 22nd August, the seedlings suffered heavily from secondary infection, while in the areas sown a few days later the plants showed little disease, and the September sowings in most cases escaped entirely. These observations do not support Massey's opinion that the fate of the cotton crop, as far as black-arm is concerned, is decided during the period of the germination of the seed [ibid., x, p. 661]. Serious secondary attack was practically confined to areas on which more than 100 mm. rain were recorded after sowing was commenced, and the damage done was most severe in the areas where the rainfalls were the heaviest.

The secondary infection, the first signs of which were detected about 18th September, chiefly came from land sown to cotton during the previous season, infection being usually heaviest on the side next to the latter. The rapid increase of the disease often observed is probably due, not so much to spread from the first infected plants, as to a progressive activation of the causal bacterium, which is distributed in an inactive condition over the whole area long before any signs of the disease are observable. During the 1931–2 season the inactive bacterium was presumably all the time in contact with or near the cotton seedlings, and was roused to activity by the heavy rainstorms that occurred on the 21st and 22nd August; this is supported by recent work by Archibald, who showed that blackarm can be induced in a healthy cotton plant by scattering dry dust containing infective material upon the leaves and keeping the latter sufficiently moist, and who also recovered the organism from dust washed from leaves collected in the field from apparently healthy plants. While volunteer cotton seedlings from the previous crop, if diseased, are a possible source of secondary infection, they are only a few inches high at the critical period, and are often surrounded and overtopped by a dense growth of weeds and grass, so that it is difficult to understand how raindrops, or spray, could carry infection for more than a very limited distance. On the other hand, there is no doubt that in the Gezira infective dust and diseased cotton débris are carried to very considerable distances, and can reach the current season's cotton lands long before sowing.

During the season under review the blackarm disease was in no way confined to, or more prevalent on, the poorer land, or on cotton the vitality of which had been reduced by other causes.

Miles (L. E.) & Persons (T. D.). **Verticillium wilt of Cotton in Mississippi.**—*Phytopath.*, xxii, 9, pp. 767–773, 1 map, 1932.

A wilt of cotton in Mississippi, the symptoms of which are indistinguishable from those of *Fusarium vasinfectum*, was experimentally shown to be due to *Verticillium albo-atrum*, previously reported by Sherbakoff from Mississippi and Tennessee [*R.A.M.*, viii, p. 378; xi, p. 699]. The average incidence of infection on diseased plots kept under observation for the past four years was 62·82 per cent. in 1928, 80 in 1929, 35·53 in 1930, and 17·66 in 1931. In these plots, however, *F. vasinfectum* was also present and may have been responsible for some of the wilting in the early years, though

in 1931 it was not detected. None of the 18 standard varieties tested showed any appreciable degree of resistance to the disease, which was found in almost all cases on the heavy, sedimentary loam soils of the Mississippi Delta; one locality outside the Delta limits is situated on rich, loamy, bottom land. Of 706 wilted cotton plants from 37 counties, 626 yielded cultures of *F. vasinfectum* and the remaining 80 *V. albo-atrum*.

BUTLER (J. B.) & HUMPHRIES (ANNIE). **On the cultivation in artificial media of Catenaria anguillulae, a Chytridiacean parasite of the ova of the liver fluke, Fasciola hepatica.**—*Scient. Proc. Roy. Dublin Soc.*, xx (N.S.), 25, pp. 301–324, 6 pl., 1 fig., 1932.

A detailed account is given of the authors' experiments, in which they succeeded in growing *Catenaria anguillulae* [*R.A.M.*, vii, p. 375; viii, pp. 172, 571] on media prepared from agar, extract from liver-fluke (*Fasciola hepatica*) eggs ground either in a fresh condition between glass slides or ground after desiccation with kieselguhr, and flaked coagulated egg albumen. The outgrowths into the medium developed from sporangia contained in infected liver-fluke eggs, and at first resembled dehiscence tubes, which, however, failed to open, but gave a branched thallus on which new sporangia developed in the medium. The zoospores from these were successfully germinated on a medium composed of equal parts of agar, eggs ground with kieselguhr, and water, and gave rise to free thalli on which further sporangia formed and discharged.

In culture *C. anguillulae* produced a much more extensive growth than when occurring as a parasite of the liver-fluke eggs. In one case, a single thallus produced over 20 hyphal strands, each bearing, on an average, 3 to 4 sporangia; in another case, it was estimated that an outgrowth from an egg, possibly consisting of only one thallus, contained over 700 sporangia. There was no evidence of the presence of turbinate organs, and resting spores were seen in only two cases.

KANOUSE (BESSIE B.). **A physiological and morphological study of Saprolegnia parasitica.**—*Mycologia*, xxiv, 5, pp. 431–451, 2 pl., 1932.

*Saprolegnia parasitica* Coker, the species to which the author refers the fungus so frequently reported as injurious to fish in various parts of the world, was isolated from five species of fish from Michigan, and produced, on certain media of a reduced nutritive value, terminal or intercalary, hyaline, smooth, thin-walled, piriform to subspherical or spherical oogonia, 65 to 135 by 60 to 75 or 65 to 95 $\mu$ in diameter, with 1 to 5 small, clavate to subcylindrical antheridia borne on branches of diclinous or androgynous origin. The oospores are variable in number, of a rich golden-brown, and 18 to 22 $\mu$ in diameter. The production of this, previously unknown, sexual stage was stimulated by peptone in combination with leucin or maltose in solution, or with glucose or maltose in synthetic agar; it was also produced on sterilized hemp seed in water.

*S. parasitica* [a revised diagnosis of which is given] was not found to be a vigorous parasite on the eggs and young fry of trout kept under controlled conditions in the laboratory. Infection, when it did occur, was usually deferred until the vitality of the host was probably lowered.

BLANK (I. H.). **Studies of the physiology of molds. III. Molding of pickled sheep skins.**—*Journ. Amer. Leather Chem. Assoc.*, xxvii, 9, pp. 380–392, 4 pl., 1932.

The darkly pigmented hyphae of certain moulds, e.g., a species of *Hormodendrum*, were found to penetrate pickled sheep-skin hides so deeply as to cause permanent discoloration. A species of *Monilia* with green hyphae also grows into the skin. A yellow to red pigment produced by a species of *Penicillium* diffuses into the skin and is taken up by the fibres. The last two organisms are also characterized by proteolytic activity.

The effect of various concentrations of sodium chloride, mineral acids, and acetic acid on the growth of these and other moulds is described. Two types of pickle liquors have been prepared which give skins relatively resistant to moulding, viz., sodium chloride (6 gm. per 100 c.c. water), sulphuric acid (1·5 gm.), and sodium acetate (1 gm.); and sodium chloride, sulphuric acid (same amounts), and paranitrophenol (0·025 gm.).

WATTS (J. W.). **Torula infection: a review and report of two cases.**—*Amer. Journ. of Path.*, viii, 2, pp. 167–191, 5 pl., 1932.

Full clinical details are given of two fatal cases of human *Torula* infection. In the first, infection was generalized but the symptoms were almost entirely cerebral, while in the second embolic phenomena were present. Two strains of yeast-like bodies were isolated, one producing no pigment and the other forming a yellow one. Inoculation experiments on laboratory animals gave negative results. Entry is thought to be probably effected through the respiratory tract and dissemination to occur by means of the blood stream.

FUJII (S.). **Über die Erreger der Trichophytie am unbehaarten Körperteile in der Umgegend von Tokyo, insbesondere Sabouraudites ruber var. III.** [On the agents of trichophytosis of the hairless region of the body in the vicinity of Tokyo, especially *Sabouraudites ruber* var. III.]—*Japanese Journ. of Dermatol.*, xxxii, 9, pp. 775–784, 7 figs., 1932.

*Sabouraudites asteroides* [*Trichophyton mentagrophytes*: *R.A.M.*, ix, p. 593; x, p. 243; xi, p. 44] was identified as the agent in 363 of the 405 cases of trichophytosis investigated by the writer in and near Tokyo during 1930, the remainder being due to *S. ruber* (33), *Epidermophyton inguinale* [*E. floccosum*: see next abstract] (4), *S. interdigitalis* [*T. mentagrophytes*] (1), *Bodinia glabra* [*T. glabrum*: ibid., x, p. 596] (2), and a new variety of *S. ruber* (var. III), which produced a generalized eczematic condition of the body. The last-named fungus is characterized by deep brownish-purple colonies on Sabouraud's agar, undulating hyphae 4 $\mu$ in diameter, spores 4·5 $\mu$ in diameter (or 5 by 3·5 $\mu$ when elongated-

spherical), 4- to 8-septate spindles, chlamydospores 8·5 $\mu$ in diameter, and a few 'giant' spores (6·5 $\mu$ in diameter).

LOMHOLT (S.). **Zwei Fälle von Epidermophytie an den Füssen mit hämatogener Aussaat von Epidermophytiden an Händen, Armen und Beinen.** [Two cases of epidermophytosis of the feet with haematogenous extensions of epidermophytids on the hands, arms, and legs.]—*Dermatol. Wochenschr.*, xcv, 37, pp. 1325–1328, 3 figs., 1932.

Details are given of two cases of epidermophytosis of the feet, with haematogenous extensions of dysidrotic epidermophytids on the legs, arms, and hands. The causal organism was readily identified as Kaufmann-Wolf's fungus (*Epidermophyton interdigitale*) [*R.A.M.*, xi, pp. 44, 458]. In Denmark this condition has not yet assumed the proportions in which it is reported from the United States, but the recent examination of 97 Copenhagen students revealed infection by the above-mentioned fungus in 21 cases, by *E. inguinale* [*E. floccosum*: ibid., xi, p. 575] in 3, and by *Achorion quinckeanum* in one.

BURNHAM (C. R.). **The inheritance of Fusarium wilt resistance in Flax.**—*Journ. Amer. Soc. Agron.*, xxiv, 9, pp. 734–748, 2 diags., 1932.

Full details are given of a study conducted at the Department of Genetics, Wisconsin Agricultural Experiment Station, on the inheritance of resistance to flax wilt (*Fusarium lini*) [*R.A.M.*, xi, p. 182].

A field wilt test of selections from a collection of varieties of widely separated geographical origin indicated that certain strains are completely susceptible, others highly resistant, while some breed true for intermediate degrees of susceptibility. In the $F_3$ generation of the cross between the susceptible Williston Golden and a resistant Argentine selection, only a small percentage of the families were as resistant as the resistant parent, most of them falling into the highly susceptible group, while a few were intermediate. A slight indication was obtained of linkage between susceptibility and one of two duplicate factors for yellow seed-coat colour. Crosses between certain resistant strains of different origin showed a high percentage of wilt, suggesting that they may carry different factors for resistance, a matter of some importance in the breeding of new resistant strains. In a cross of two susceptible strains (American and Abyssinian), almost a third of the 46 $F_3$ families showed some degree of resistance, pointing to transgressive segregation. Tests in further generations, however, are necessary to elucidate this problem.

JENKINS (ANNA E.). **Rose anthracnose caused by Sphaceloma.**—*Journ. Agric. Res.*, xlv, 6, pp. 321–337, 7 pl., 6 figs., 1932.

This is a full account of the author's investigation, started in 1925, of the rose disease attributed by Passerini to *Phyllosticta rosarum* [*R.A.M.*, xi, p. 517], for which the common name 'rose anthracnose' suggested by Cobb in 1903 is accepted. A review of the literature, supported by the examination of numerous

herbarium and living specimens (the latter intercepted by the United States Customs) indicates that the disease occurs in practically every continent of the world. There are records of it in France in 1828 and in the United States in 1869. In spite of this, it appears to have escaped notice, or was confused with other rose diseases, especially black spot (*Diplocarpon rosae*) [ibid., xii, p. 25].

Besides the leaves, on which only it has been described heretofore, the disease also attacks the stems and blossoms. On the leaves the lesions are often dark purplish-black above, and are sometimes bordered by a narrow, dull, livid brown band, which is often their colour on the lower side. A white or ashen coloration may result from a lifting of the cuticle or from etiolation of the leaf tissue on the surface where the fungus first gained entrance, usually the upper surface. On the stems the lesions are considerably smaller than on the leaves (seldom over 2 mm. in diameter); they are usually circular or elongated along the stem, raised (sometimes depressed at the centre), dull livid brown, becoming white or ashen in the centre. The lesions on the blossom pedicels and hips resemble those on the stem, while on the calyx lobes they resemble the leaf lesions; so far, lesions on the petals have not been definitely diagnosed.

Since no perfect stage of the pathogen has yet been found, and its imperfect stage [morphological and cultural details of which are given] is typical of *Sphaceloma* rather than of *Phyllosticta*, the fungus is transferred to the former genus as *S. rosarum* n. comb. Inoculation experiments, supported by extensive observations in the United States, showed that, besides a large number of commercial varieties, the fungus attacks a wide range of wild species, and is of considerable economic importance. The inoculation of roses with *Elsinoe veneta* [ibid., xi, p. 724], with which the author previously identified *S. rosarum*, gave negative results, and the latter is now considered to be a distinct species.

TAUBENHAUS (J. J.) & EZEKIEL (W. N.). **On a new damping-off disease of Texas Bluebonnets.**—*Mycologia*, xxiv, 5, pp. 457–459, 1 fig., 1932.

Young Texas bluebonnet (*Lupinus texensis*) plants collected in the country and potted in a greenhouse at College Station, Texas, were attacked by a crown rot and damping-off disease which was shown by isolations and inoculations to be caused by *Pythium de Baryanum* and a species of *Rhizoctonia* culturally resembling *R.* [*Corticium*] *solani*. Both organisms were shown to be soil-borne, and to be controllable by steam sterilization of the soil and disinfection of the plants before transplanting.

NEWTON (W.), HASTINGS (R. J.), & BOSHER (J. E.). **Botrytis tulipae (Lib.) Lind. II. Bulb dips.**—*Scient. Agric.*, xiii, 2, pp. 110–113, 1 fig., 1932.

Experiments [some details of which are given] showed that immersion for one hour in mercuric chloride or uspulun solutions (the *dosis curativa* and *dosis tolerata* of which were shown to be 0·03 and 0·1, and 0·5 and 1·5 per cent., respectively) gave the best and safest disinfection of tulip bulbs against *Botrytis tulipae*

[*R.A.M.*, xi, p. 460]; it also gave the best protection against soil-borne infection. Copper sulphate and potassium resin polysulphide [ibid., x, p. 198] proved to be unsuitable, as they caused injury to the plants at concentrations ineffective against the fungus.

Landgraf (T.). **Die Stammfäule oder Fusskrankheit der Sinningia (Gloxinia.)** [The stem rot or foot disease of *Sinningia* (*Gloxinia*).]—*Blumen- und Pflanzenbau*, xlvii, 9, pp. 134–135, 1 fig., 1932.

Gloxinias in the Hamburg district are reported to have suffered considerably of recent years from the attacks of the so-called 'propagation fungi', including *Pythium, Phytophthora, Botrytis*, and *Moniliopsis* spp. The first symptom of infection is a relatively inconspicuous discoloration of the basal leaves, which is rapidly followed by wilting and eventually by the collapse of the whole plant. Closer examination reveals a greenish- to brownish-black discoloration of the basal parts of the stem, the epidermal tissues of which are rotted. Subsequently infection spreads to the bulb as well as to the aerial parts of the plant. The popular blue-flowering varieties are much more susceptible than the white, for which there is little demand. Good control (reduction of losses from 100 to 25 per cent.) was effected by placing sand around the underground parts of the stem.

Adam (D. B.). **Rust disease in Boronia.**—*Journ. Dept. Agric. Victoria*, xxx, 8, pp. 389, 391, 1932.

A popular note is given on the rust of the perennial sweet-scented *Boronia megastigma* (widely cultivated in Australia on a commercial scale) due to *Puccinia boroniae*, and on its control by propagation from resistant seedlings.

Nicolas (G.) & Aggéry (Mlle). **Une maladie du Laurier-Cerise en Suisse.** [A disease of the Cherry-Laurel in Switzerland.] —*Rev. Path. Vég. et Ent. Agric.*, xix, 4, pp. 174–176, 1 fig. (on pl. facing p. 172), 1932.

The examination of diseased leaves of cherry-laurel [*Prunus laurocerasus*] sent in from Switzerland in 1931, failed to show the presence in the still living but discoloured tissues of a fungal mycelium, while the dead, grey tissues were invaded by an unidentified species of *Heterosporium*, a few morphological details of which are given. The presence in the living tissues of very numerous bacteria (which were not more closely studied) leads the authors to believe that these are the primary cause of the disease, resulting in a severe stunting and yellowing of the leaves, and that the *Heterosporium* is only a secondary infection developing on the moribund tissues. Lack of material prevented them from making inoculation experiments.

Burkholder (W. H.) & Guterman (C. E. F.). **Synergism in a bacterial disease of Hedera helix.**—*Phytopath.*, xxii, 9, pp. 781–784, 1932.

Two distinct types of bacteria were isolated from single lesions on ivy (*Hedera helix*) leaves among a consignment sent from

Georgia to a New York firm. Both the organisms produced round, yellow colonies on beef extract-agar, but one was of a paler colour and grew less rapidly than the other. Inoculation tests showed that only the former was pathogenic when used alone.

It is evident from a comparison of the present symptoms with those of previously described bacterial diseases of ivy in Germany [cf. *R.A.M.*, vi, p. 298], France, and the United States, that the same disease is involved. Water soaked spots appear on the leaves, later developing dark brown to black centres (which crack as they become dry) and reddish-purple margins. The non-pathogenic bacterium, though innocuous alone, acted as a temporary accelerator when combined with the slow growing pathogen. The latter, used alone or with the rapidly growing non-pathogenic organism, produced practically 100 per cent. infection.

The pathogen, to which the name of *Phytomonas hederae* is given, is a slender rod, Gram-negative, motile by means of a single polar flagellum, non-sporulating, 2·13 by 0·6 $\mu$, forming amber-yellow, watery to butyrous colonies on beef extract-agar, turning milk alkaline, liquefying gelatine, producing ammonia in peptone broth, fermenting dextrose, levulose, galactose, xylose, lactose, sucrose, and glycerol without gas, as well as the sodium salts of acetic, citric, lactic, malic, and succinic acids, and facultatively anaerobic.

The accelerator, which is not named but appears to resemble *Bact. herbicola aureum* [ibid., v, p. 162], is a short rod, sometimes oval with a central granule, Gram-negative, motile by means of one or two polar flagella, non-sporulating, 1·7 by 0·9 $\mu$, forming antimony-yellow, butyrous colonies on beef extract-agar, turning milk first alkaline, later neutral or slightly acid, producing ammonia in peptone broth, fermenting dextrose, levulose, galactose, arabinose, xylose, rhamnose, sucrose, glycerin, mannitol, and salicin without gas, as well as the above-mentioned sodium salts, and facultatively anaerobic.

VERONA (O.). **Note micologiche sulle Pandanacee.** [Mycological notes on the Pandanaceae.]—*Nuovo Giorn. Bot. Ital.*, N.S., xxxix, 3, pp. 454–476, 9 figs., 1932.

Notes are given on a collection of fungi on species of Pandanaceae from various parts of the world, together with a few on Freycinetiae. Several new species are described, including *Dimerosporium pandani* on withered leaves of *Pandanus lambooensis* and *Gloeosporium pandani* on the pericarp of withered fruits of the same host, both from Upolu (Samoa Islands). The former is characterized by gregarious, superficial, carbonaceous, irregularly ruptured, globose or depressed perithecia arranged in a gradually enlarging black spot on the under surface of the leaves; the spheroidal or subspheroidal asci measured 48 to 52 $\mu$ in diameter and contained eight ovoid, uniseptate, hyaline spores measuring 32 by 16 $\mu$. *G. pandani* showed black, subcutaneous, then erumpent acervuli, ovoid, hyaline conidia measuring 9 to 10 by 4·5 to 6 $\mu$, and fasciculated, simple, short, continuous, hyaline or subhyaline conidiophores.

NISIKADO (Y.). **Beiträge zur physiologischen Spezialisierung Obstfäule erregender Fusarien.** [Contributions to the physiologic specialization of the *Fusaria* causing fruit rot.]—*Zeitschr. für Parasitenkunde*, iv, 2, pp. 301–330, 3 figs., 1932.

This is a slightly condensed version of the writer's investigations on physiologic specialization in the fruit-rotting fungi *Fusarium lateritium* [*Gibberella moricola*] from citrus and raspberry, *F. lateritium* var. *fructigenum* from apple, citrus, and *Salix*, and *F. oxysporum* from various sources, a full account of which has already been noticed [*R.A.M.*, xi, p. 306].

WORMALD (H.). **Blossom wilt of fruit trees.**—*Journ. Min. Agric.*, xxxix, 7, pp. 620–626, 1 pl., 1932.

Referring to the serious reduction in the 1932 crops of cherries, plums, and apples in England caused by severe outbreaks of blossom wilt (*Sclerotinia cinerea*) [cf. *R.A.M.*, xi, p. 58], the author gives a brief outline of the factors that favour the development of the disease on fruit trees in the spring, and also a concise description of the symptoms produced in the different hosts [ibid., xi, p. 311]. Among the measures recommended for the control of the trouble, stress is laid on the routine cutting out of brown rot cankers, and of all infected spurs and twigs.

CHANDLER (W. H.), HOAGLAND (D. R.), & HIBBARD (P. L.). **Little-leaf or rosette in fruit trees.**—*Proc. Amer. Soc. Hort. Sci. 1931*, xxviii, pp. 556–560, 1 pl., 1932.

The disorder known as 'little leaf', which affects all the stone fruits, as well as walnuts, citrus, grapes, and other plants in California [*R.A.M.*, viii, pp. 208, 550; x, p. 324; xi, p. 570], is thought to be probably identical with that described from Washington and elsewhere on apples as 'rosette' [ibid., iii, p. 341], but the continued use of the former term is recommended in order to avoid confusion with peach rosette [ibid., x, p. 601]. The trees most likely to be affected are those growing on deep, well-drained, sandy or gravelly soils with a relatively small admixture of clay and a hydrogen-ion concentration between $P_H$ 6·8 and 8. In Washington uniformly satisfactory results in reducing the trouble have been obtained by the continuous cultivation of lucerne in orchards, while in California this practice has not been invariably successful, though recovery has taken place in a fair number of peach, apricot, and plum trees after some three years in a good lucerne stand. In experiments started in 1928, some details of which are given, it was found that applications of ferrous sulphate to the soil around diseased trees led to an improvement, which is believed to be largely due to the presence of a certain amount of zinc sulphate, no benefit following treatment with chemically pure ferrous sulphate. When Belgian ferrous sulphate was applied, containing a much lower proportion of zinc sulphate than the American, the resultant improvement was correspondingly less. Ferrous sulphate forced into the soil through a pipe attached to a spray machine was much less effective in the correction of little leaf than when spread over the surface of the soil in a radius of 3 to 4 ft. from the trunk. When the amount of zinc was adequate

the application always corrected the trouble, no matter what kind of tree was treated. It is believed that the action of the zinc is indirect, either by neutralizing some injurious substance in the soil or by affecting the soil flora.

SHERBAKOFF (C. D.). **The more important diseases of Apples in Tennessee.**—*Tennessee Agric. Exper. Stat. Bull.* 145, 54 pp., 11 figs., 1 diag., 1932.

Popular notes are given on the symptoms, mode of infection, and control of the following apple diseases in Tennessee: blotch [*Phyllosticta solitaria*], scab [*Venturia inaequalis*], bitter rot [*Glomerella cingulata*], black rot [*Physalospora cydoniae*], fire-blight [*Bacillus amylovorus*], rusts [*Gymnosporangium juniperi-virginianae*, *G. germinale*, and *G. globosum*: *R.A.M.*, xi, p. 412 and next abstract], blister canker [*Nummularia discreta*: ibid., ix, p. 461], black root rot [*Xylaria polymorpha*: ibid., vii, p. 465], and bitter pit. The bulletin further contains numerous observations on varietal reaction to the above-mentioned diseases and much useful information on local spraying schedules, the relative merits and mode of application of different fungicides, and orchard sanitation.

MILLER (P. R.). **Pathogenicity of three Red-Cedar rusts that occur on Apple.**—*Phytopath.*, xxii, 9, pp. 723–740, 2 figs., 1932.

This is an expanded account of the author's studies in Indiana on the pathogenicity of three species of *Gymnosporangium* infecting apples, viz., *G. germinale*, *G. juniperi-virginianae*, and *G. globosum* [see preceding abstract], a preliminary note on which has already appeared [*R.A.M.*, x, p. 391]. The optimum temperature for teleutospore and basidiospore germination in all three species was found to be 24° and 16° C. respectively; the aecidiospores of *G. juniperi-virginianae* and *G. globosum* germinated best at 24° and those of *G. germinale* at 16°. The aecidiospores of *G. juniperi-virginianae* survived the winter and germinated well in March or April, some being viable as long as a year after collection.

GOODWIN (W.), SALMON (E. S.), & WARE (W. M.). **The control of Apple scab on Worcester Pearmain and Allington Pippin; a three years' experiment.**—*Journ. South-Eastern Agric. Coll., Wye, Kent*, xxx, pp. 28–50, 4 figs., 1 plan, 1932.

In a spraying test against scab [*Venturia inaequalis*: cf. *R.A.M.*, xi, p. 113] conducted in Kent in 1929, Worcester Pearmain and Allington Pippin apple trees after one pre- and two post-blossom applications of home-made Bordeaux mixture (8–12–100) yielded, respectively, 76 and 65 per cent. by weight of clean fruit, the corresponding figures for the unsprayed controls being only 19 and 12 per cent. About 15 per cent. by weight of the Worcester Pearmain apples showed distinct russeting. In the following year a pre-blossom application of Bordeaux mixture (8–8–100) and two post-blossom applications (8–12–100) gave 96·1 per cent. clean Worcester Pearmain fruit and 86·2 per cent. clean Allington

Pippins; when lime-sulphur (1 in 60) was substituted for Bordeaux in the two post-blossom applications, the corresponding figures were 83·8 and 88·4 per cent., as against 48·5 and 24·3 per cent. in the unsprayed controls. On the Worcester Pearmain trees the Bordeaux mixture alone and the same followed by lime-sulphur gave, respectively, 7·9 and 4 per cent. by weight russeted fruit, as compared with 0·8 per cent. in the unsprayed controls. On the Allington Pippin trees the Bordeaux mixture alone caused only negligible russeting, while the same followed by lime-sulphur gave 2·6 per cent. russeted fruit, as compared with 0·3 per cent. in the controls. In 1931, three applications of Bordeaux mixture (8–12–100) gave 87·5 and 73·7 per cent. clean fruit on the Worcester Pearmain and Allington Pippin trees, respectively, the controls giving 8·6 and 7·5 per cent. One pre-blossom application of lime-sulphur (1 in 30) with two post-blossom applications (1 in 60) gave 45·8 and 55·7 per cent. clean fruit on the Worcester Pearmain and Allington Pippin trees, respectively. On the former variety the Bordeaux treatment gave 7·3 per cent., and the lime-sulphur 1·36 per cent. (by number) severely russeted apples, as against 0·24 per cent. in the controls; on the Allington Pippin trees the Bordeaux mixture caused only negligible russeting, and the lime-sulphur still less.

It is concluded that with both varieties home-made Bordeaux mixture is more effective than lime-sulphur against scab. Bordeaux mixture may, however, cause serious russeting and discoloration on Worcester Pearmain apples, and where a high finish is required on this variety lime-sulphur should be substituted. It is considered that to obtain complete control two pre-blossom applications would have been required.

GOODWIN (W.), SALMON (E. S.), & WARE (W. M.). **The control of Apple Scab. I. Allington Pippin and Newton Wonder.**—*Journ. South-Eastern Agric. Coll., Wye, Kent*, xxx, pp. 51–62, 1 fig., 1932.

In further spraying tests against apple scab [*Venturia inaequalis*: see preceding abstract] conducted in Kent in 1931, Allington Pippin trees given one pre- and two post-blossom applications of Bordeaux mixture (8–12–100) and those given one pre-blossom application of lime-sulphur (1 in 30) followed by two post-blossom applications at 1 in 100 [cf. *R.A.M.*, xi, p. 114] yielded, respectively, 75 and 33 per cent. scab-free fruit, as compared with 9 per cent. in the unsprayed controls, only 1·46 per cent. of the fruit from the trees sprayed with the Bordeaux mixture being appreciably russeted. When the same treatments were given to Newton Wonder trees, those sprayed with Bordeaux mixture gave 50·7 per cent. and those with lime-sulphur 2·7 per cent. clean fruit, as compared with 0·8 per cent. in the controls. The attack appeared to be much more severe on the Newton Wonder trees than on the Allington Pippins. The poor results obtained from the Bordeaux mixture on the former variety are considered to indicate that in years when scab is as severe as in 1931 an extra pre-blossom application should have been made, before the first actually given,

or possibly an additional late one, after the second post-blossom application.

As lime-sulphur, unless much diluted, may cause defoliation on Newton Wonder trees, and as good or fair control had been obtained in previous seasons, Bordeaux mixture is still recommended for this variety.

The rapidity with which the disease spread late in the season is illustrated by the fact that one plot of Allington and Newton Wonder trees, in which on 28th July approximately 70 and 85 to 90 per cent., respectively, of the apples appeared to be scab-free, at picking time showed only 33 and 3 per cent., respectively, clean fruit.

Pierstorff (A. L.). **A centralized scab-spray service.**—*Phytopath.*, xxii, 9, pp. 759–766, 1 fig., 1 map, 1932.

Details are given of the mode of organization of the apple scab [*Venturia inaequalis*] spray service in Ohio [*R.A.M.*, ix, p. 726]. Thanks to improvements in the telephonic, telegraphic, and broadcasting systems of communication, it has been possible to adopt a centralized plan, whereby one individual, in consultation with other pathologists and co-operators in different parts of the State, makes recommendations for the time of application of the various sprays. The notifications are based on three factors, viz., the stage of fruit bud development, the percentage of mature ascospores of the fungus, and the probable weather for the next two or three days [cf. ibid., x, p. 776; xi, p. 309]. The average percentage of disease-free fruit harvested from 1928 to 1931, inclusive, by a group of about 100 growers following the official recommendations was 95·75.

Brooks (C.), Miller (E. V.), Bratley (C. O.), Cooley (J. S.), Mook (P. V.), & Johnson (H. B.). **Effect of solid and gaseous carbon dioxide upon transit diseases of certain fruits and vegetables.**—*U.S. Dept. Agric. Tech. Bull.* 318, 59 pp., 34 graphs, 1932.

With strawberries at a temperature range of 32° to 77° F., the transit rots caused by *Botrytis cinerea* and *Rhizopus nigricans* [*R.A.M.*, x, p. 254; xi, p. 585] were fairly well inhibited by 23 per cent. of carbon dioxide and completely controlled by 37 per cent. or more of the gas. In inoculation tests *B. cinerea* on Bartlett pears and *Monilia* on Italian prunes were entirely checked by 20 to 30 per cent. carbon dioxide and considerably inhibited by 12 to 15 per cent. [cf. ibid., ix, pp. 533, 534]. In a series of experiments with *Sclerotinia fructicola* [*S. americana*] on peaches [ibid., x, p. 192], it was found that within the range of 10 to 50 per cent. carbon dioxide the average reduction in the virulence of the fungus was about twice that of the percentage of gas used. At 77°, within a range of 10 to 40 per cent., the carbon dioxide produced an effect on the rot approximately equivalent to that of reducing the temperature as many degrees as the percentages used. At lower temperatures the loss of virulence of the fungus was as great, if not greater. Good control was also given of internal breakdown in Bartlett pears [ibid., ix, p. 254] and of

soft scald [ibid., xi, pp. 53–5] and other diseases in Grimes Golden, Delicious, and Jonathan apples by carbon dioxide treatment, which further proved effective against *B. cinerea* in grapes.

The experiments were carried out in refrigerators at constant temperatures with a constant percentage of carbon dioxide, and also in standard refrigerator cars. Solid carbon dioxide was used as a supplementary refrigerant and as a source of the gas. Limitations to this otherwise successful treatment are set by its objectionable effects on the flavour of the fruit, especially in the case of peaches, apricots, strawberries, and red raspberries. Grapes, peas, maize, and carrots showed no adverse effects as a result of the treatment, while plums, cherries, apples, pears, currants, oranges, and certain other fruits were intermediate in this respect.

WORMALD (H.). **Apples should be picked with their stalks!**—*Gard. Chron.*, xcii, 2385, p. 200, 2 figs., 1932.

A case of brown rot (*Sclerotinia fructigena*) in Sussex apples of the Early Victoria, Grenadier, and Gladstone varieties, due to careless picking, is briefly described. As in a similar instance reported in 1927 [*R.A.M.*, v, p. 178], the infection was found to arise at the wounds made by picking the fruits away from the stalk instead of with it. The rot developed on the apples in the market on 11th August, picking having been commenced three days previously. *S. fructigena* was readily isolated in the laboratory from the diseased fruit.

ALLEN (F. W.). **Maturity and rate of ripening of Gravenstein Apples in relation to bitter pit development.**—*Proc. Amer. Soc. Hort. Sci. 1931*, xxviii, pp. 639–645, 4 diags., 1932.

The writer has previously shown (*Proc. Amer. Soc. Hort. Sci.*, 1930) that Gravenstein apples held for immediate ripening developed less bitter pit at 70° F. than at 50°, and similar results were obtained in 1931 in tests with fruit kept for ten days at 32°, 50°, and 70° and subsequently removed to a temperature of 70° to 75° for ripening. The low temperature (32°) retarded the initial development of bitter pit, but failed to maintain the fruit in good condition after its removal from storage, while the apples kept continuously at 70° or higher were least affected by the disease during the time they were in the best state for eating. In connexion with Carne's theory as to the role of starch in the causation of bitter pit [*R.A.M.*, vii, p. 102; x, p. 115], it may be mentioned that the starch content of the apples held for ten days at 70° was only half that of comparable lots at 50°, at which temperature the fruit became most severely disorganized. Some indication was given that ethylene gas (three treatments at 1 in 1,000) decreases the incidence of bitter pit by accelerating starch dispersion.

DAVIS (L. D.) & TUFTS (W. P.). **Black-end and its occurrence in selected Pear orchards.**—*Proc. Amer. Soc. Hort. Sci. 1931*, xxviii, pp. 634–638, 1 diag., 1932.

Individual tree records have been made since 1929 in a number of Californian Bartlett pear orchards in which black-end occurs

[*R.A.M.*, vi, p. 493]. The results [which are tabulated and discussed] showed that the distribution of the affected trees in the orchard is of a purely random character irrespective of the type of soil, an observation that points to the implication of factors as yet unknown. Trees producing black-end fruit in one year generally continued to do so in succeeding seasons, while the relative severity of the condition on a given tree was also maintained from year to year. The largest number of black-end trees occurred among those on *Pyrus serotina* rootstocks, Kieffer seedling coming next in this respect and *P. ussuriensis* producing the lowest incidence. In 1931 it was found that the first black-end fruits were formed on trees showing the highest amount of disease in the previous year.

MILLS (W. D.). **A severe outbreak of leaf rust on cultivated Raspberry in New York.**—*Plant Disease Reporter*, xv, 13, pp. 135–136, 1931. [Mimeographed. Received December, 1932.]

Latham red raspberries in Herkimer County, New York, were found in September, 1931, to be severely infected by *Puccinastrum americanum* [*R.A.M.*, iii, p. 218; ix, p. 73], which had evidently spread from a row of wild raspberries bordering the planting. The under leaf surfaces up to the terminal foot of every cane were covered with the yellow spores of the rust. Over 5,000 plants were attacked. One leaf of an adjacent Cumberland black raspberry [*Rubus occidentalis*] also bore a lesion due to *P. americanum.* Wild red raspberries in other parts of the county were also attacked by the rust, but much less severely than the cultivated Latham, while the wild black ones were free from this rust but bore abundant teleutosori of *Gymnoconia interstitialis* [ibid., x, pp. 116, 164].

[SUTHERLAND (J. B.).] **Banana breeding, etc.**—*Journ. Jamaica Agric. Soc.*, xxxvi, 9, pp. 463–465, 1932.

In a lecture describing his efforts to evolve a banana in Jamaica resistant to Panama disease [*Fusarium oxysporum cubense*: cf. *R.A.M.*, xii, p. 39] the author, who is in charge of the banana breeding work in the island, stated that in 1924 he planted several varieties obtained from Kew, and made numerous crosses with the Jamaica banana and others, some of which produced viable seed. The seedlings 7, 17, 19, and 40 were all very promising, Gros Michel × Robusta being the most successful cross.

WARDLAW (C. W.) & MCGUIRE (L. P.). **Control of wastage in Bananas with special reference to time and temperature factors.**—*Empire Marketing Board Publ.* 60, 103 pp., 25 pl., 11 graphs, 1932.

In the section of this report [cf. *R.A.M.*, xi, pp. 382, 383, 464, 727] dealing with time and temperature factors in relation to fungal infection of stored bananas [ibid., x, p. 806] it is stated that fungal wastage in storage is primarily due to mechanical injury sustained during handling, and to atmospheric humidity prevailing when infection is probable. Fungal activities can be kept

sufficiently in abeyance provided that the interval between picking and loading is short, and that the fruit is rapidly cooled down to 53° F.

In inoculation experiments with *Botryodiplodia theobromae* (by far the most active of the rotting fungi encountered) [cf. ibid., xi, p. 190] at various temperatures and degrees of ripeness, it was found that on 'heavy full' grade fruit (the ripest used in transport) the fungus in only four days at 82° to 83° produced chocolate-coloured skin blemishes 2 to 3 cm. long, rendering the fruit very unsightly and causing premature ripening; a characteristic brown, semi-liquid decay was also already present in the underlying flesh. On '½ full' grade fruit, sunken brown skin blemishes were produced, soon accompanied by premature yellowing, though the underlying flesh was as yet unaffected. When the same two grades of fruit were kept at 53° from the outset or placed at that temperature after one day at 76°, no blemishes were noted. When the inoculated fruit was exposed for three days at 76° before being transferred to 53°, the initial growth of the fungus was sufficient to show that serious rotting during the usual storage period was inevitable.

On a standard synthetic medium *B. theobromae* at 82° grew at the rate of 4 cm. a day; at 76° and 70° growth was proportionately slower, and at 53° it amounted to only 0·6 cm. per day. The injury to fruit at the higher temperatures is due both to accelerated ripening and increased rate of fungal growth.

Inoculated 'heavy full' fruit kept for seven or eight days at 53° and then for four days at 70°, ripened normally, and remained free from significant fungal damage.

Even when *B. theobromae* was applied to freshly made wounds under conditions highly favourable to disease production, infection was largely prevented by rapid cooling to 53°. Fruit on which fungal activity had been kept at a minimum during cool storage suffered severely in some instances by slow ripening at 70°; with '¾ full' fruit (the usual grade for export to England), free from blemish when transferred to 70°, serious fungal invasion took place between the seventh and tenth days in the ripening room. When the fungus had made a good start at tropical temperatures, even the most rapid cooling to 53° did not wholly arrest its further progress, though rapid cooling of the fruit flesh to between 53° and 55° does afford a very satisfactory degree of control, and should, if possible, be effected in two days.

Mycologically, the degree of atmospheric humidity in the ship's hold is of the utmost importance, especially during the initial stages of an attack, when pathogens are becoming established in the tissues. When *B. theobromae* was applied on culture jelly almost every inoculation produced infections at favourable temperatures, but when spore suspensions in water were used under similar conditions, 10 per cent. only of the inoculations were successful when humidity was low.

When bananas kept for one day at 82°, then for two days at 60°, then up to the sixteenth day at 53°, and transferred on the seventeenth day to 70° (thus simulating transport to England and ripening there) were wounded and inoculated on the first, eighth,

twelfth, fifteenth, and seventeenth days, respectively, the greatest wastage resulted from inoculations on the first day. Infections developing on board ship may ultimately entail less waste than wounds acquired and infected after the voyage, while the fruit is being transported to or is in the ripening rooms.

Earlier investigations having demonstrated that finger-dropping may be caused by rots spreading from the main stalk, experiments were carried out by inoculating the stalk just above the finger cushion with *B. theobromae*, and storing at 53° after one day at 82° (control), or one day at 82° and two days at 60° (rapid cooling), or one day each at 82° and 70°, then two days at 65° and two at 60° (slow cooling), a fourth lot being stored at 53° and wounded and inoculated on the fifth day. All were removed to 70° on the seventeenth day. The total percentages of affected finger stalks for the four lots were, respectively, 16, 20, 54, and 11, the corresponding figures for the percentages of dropped fingers after eight days in the ripening room being 0, 4, 28, and 0. Rapid cooling reduces this source of finger dropping.

In tests [which are described] of the efficacy of the vaseline treatment against main stalk rotting [ibid., x, p. 45; xi, p. 63] under trade conditions, the comparatively good results obtained with freshly trimmed, unvaselined stalks indicated that freedom from extensive rotting was mainly due to rapid cooling, and that the beneficial effects of the vaseline smear chiefly result from the fact that it keeps out fallen spores and prevents desiccation and cracking of the stalks, which would otherwise facilitate fungal penetration.

A list is given of 35 fungi associated with main stalk rot and banana fruit rots in general.

MEHRLICH (F. P.). **Pseudopythium phytophthoron a synonym of Phytophthora cinnamomi.**—*Mycologia*, xxiv, 5, pp. 453–454, 1932.

The author states that in his study of the pineapple diseases associated with the fungus which was tentatively named by Sideris and Paxton *Pseudopythium phytophthoron* [*R.A.M.*, x, pp. 325, 740], he obtained the zoosporangial stage which was not observed by the previous writers. All the morphological details of the organism agree well with Rand's description of *Phytophthora cinnamomi* [ibid., i, p. 246], and its pathogenicity conforms to that indicated by Tucker for the latter species [ibid., x, p. 754]. Subcultures of the fungus were independently identified by Leonian and by Tucker as *P. cinnamomi*. On submission to Sideris these facts induced him to withhold the description of *P. phytophthoron* from publication; this binomial thus remains a *nomen nudum*.

WILCOXON (F.) & MCCALLAN (S. E. A.). **The fungicidal action of sulphur. IV. Comparative toxicity of sulphur, selenium, and tellurium.**—*Contrib. Boyce Thompson Inst.*, iv, 3, pp. 415–424, 1 fig., 5 graphs, 1932.

Continuing their studies on the fungicidal action of sulphur, which is attributed to the reduction of sulphur vapour to toxic hydrogen sulphide by the fungus spores [*R.A.M.*, xi, p. 385], the

writers investigated the comparative toxicity of sulphur and its chemically analogous elements, tellurium and selenium.

The tests were carried out with red and black (purified) and technical selenium, tellurium, and 'straight' commercial sulphur [see next abstract] dusts on the spores of *Sclerotinia americana*, *Pestalozzia stellata*, and *Uromyces caryophyllinus* [ibid., xi, p. 730]. Tellurium was found to be much less toxic than sulphur, and even in colloidal form selenium showed no appreciable fungicidal activity. The toxicity of hydrogen selenide, however, while difficult to gauge accurately on account of its instability, was apparently comparable to that of hydrogen sulphide. The formation of hydrogen selenide and of hydrogen telluride by yeast cells or glutathione was less readily effected than the reduction of sulphur to hydrogen sulphide under similar conditions.

ADAMS (J. F.). **Bacterial and fungous flora in certain sulphur fungicides.**—*Phytopath.*, xxii, 9, pp. 785–786, 1932.

In the course of toxicity tests with certain sulphur fungicides, the latter were found to be contaminated by various organisms. Representative samples of 14 fungicides were examined, including mixtures of 'straight' elemental sulphur [*R.A.M.*, xi, p. 385], modified sulphurs (containing admixtures of hydrated lime and wettable agents), and suspended sulphurs. Some of the mixtures showed bacteria in numbers exceeding 1,000,000 and fungi up to 30,000 per gm. The bacteria were mostly of the *Bacterium fluorescens* group, while the fungi were species of *Aspergillus* and *Penicillium*. The contaminants occurred chiefly in the older samples (two years or more) of modified sulphurs to which caseinate and similar substances are added to improve the wetting and physical properties. Suspended sulphurs, especially from by-products in gas manufacturing [cf. ibid., ix, pp. 580, 796], showed the heaviest bacterial flora.

**Plant pathology at the Rockefeller Institute for Medical Research, Princeton, New Jersey.**—*Science*, N.S., lxxvi, 1968, p. 250, 1932.

The Division of Plant Pathology of the Rockefeller Institute for Medical Research was due to commence work on 1st October, 1932. The accommodation provided for the division consists of a laboratory, eight greenhouses, and a potting shed; and Dr. L. O. Kunkel has been appointed head.

WILSON (J. D.). **Environmental factors in relation to plant disease and injury: a bibliography.**—*Ohio Agric. Exper. Stat. Tech. Ser. Bull.* 9, 203 pp., 1932.

This extremely useful bibliography of 3,689 titles, arranged alphabetically under authors, comprises some of the papers in botanical literature referring to the injurious influence of environmental factors on plants. The factors considered are separately indexed in the second section of the bulletin, while the diseases, injuries, and abnormalities discussed are indicated for each host in the third, which also includes, under the name of the pathogen, a list of the papers in which the action of the factor on the

pathogen only, without reference to the host, is discussed. A host index of scientific and popular names is appended.

JARVIS (T. D.). **The environmental coincidence as a factor in incidence and control of plant diseases.**—*Scient. Agric.*, xiii, 1, pp. 36–57, 1932.

This is a discussion of the evidence supplied by recent phytopathological investigations [a survey of which is given], that variations in the incidence and external expression of physiological, virus, and parasitic diseases of plants may be explained, in a large measure, in terms of the basic metabolic disturbances brought about in the plants under the influence of different complexes of environmental conditions, which the author terms environmental coincidence, and which affect the predisposition of the plant either for resistance or susceptibility. In his opinion, a better understanding of the problem of the incidence and control of plant diseases may be attained by a world-wide and international study of the ecological conditions best adapted for growing a given crop, the fundamental principles of which are briefly indicated.

JOHNSON (J.) & GRANT (T. J.). **The properties of plant viruses from different host species.**—*Phytopath.*, xxii, 9, pp. 741–757, 1932.

In order to examine some characteristic properties of viruses from different plants, a number of susceptible hosts were inoculated with the specific viruses to be tested. When infection on these plants was evident, extracts were made and treated as desired, after which inoculations were made on a series of tobacco plants to ascertain the effect of the treatment on the virus.

Four viruses were used in the study, namely, ordinary tobacco mosaic (tobacco virus 1), cucumber mosaic (cucumber virus 1) [*R.A.M.*, vi, p. 501], Wingard's tobacco ring spot [see below, p. 120], and 'spot necrosis', now recognized as a combination of two viruses [ibid., x, p. 682], special attention being paid to the 'mottle' virus constituent of the compound. Most of the plants used to test the effect of the host on these viruses were members of the Solanaceae, but cucumber and some others were added. The four properties selected for investigation were the thermal death-point, longevity *in vitro*, tolerance to dilution, and resistance to certain chemicals.

The results of the studies [which are fully discussed and tabulated] showed that in most of the hosts tested the thermal death-point for the tobacco mosaic virus is below 90° C. In no case did the cucumber mosaic virus survive 75°, and it was frequently inactivated at 60° or 65°. The thermal death-point of 'mottle' was found to be below 70° in most cases, while that of the 'spot necrosis' combination of viruses was 5° or 10° lower. The tobacco ring spot virus uniformly survived a temperature of 60°, but from some hosts it was destroyed at 65° and it never withstood 70°, so that its thermal death-point may perhaps be placed at 63° to 68°. Doolittle found (*U.S. Dept. of Agric. Bull.* 879, 1920) that the cucumber mosaic virus was never infectious after three to five days and usually lost its virulence within 24 to 48 hours. Similar results were obtained in the present trials with this virus; *Physalis*

*pubescens* tends to shorten its life to less than one day, while *Nicotiana sylvestris* and *N. glutinosa* may prolong viability beyond three days.

Tobacco mosaic extracts from all hosts, when diluted to 1 in 1,000,000, gave good infection, except those from *S. nigrum*, which showed considerable weakening at this dilution. Some instances of infection with the cucumber mosaic virus occurred at 1 in 100,000, but generally speaking there was a marked decline at 1 in 10,000. The tobacco mosaic virus proved completely resistant in all tests to the action of nitric acid (1 in 200) and 50 per cent. ethyl alcohol for 48 hours, while cucumber mosaic was largely inactivated by one hour's exposure to these treatments and entirely by 24 hours.

On the whole the results showed that the properties of the different viruses tested are not greatly modified through the influence of the host plant.

PORTER (C. L.). **Mixed cultures of bacteria and fungi.**—*Proc. Indiana Acad. Sci.*, xli, pp. 149–152, 1932.

In the author's studies of the influence on one another of certain bacteria and fungi in mixed cultures on potato dextrose agar at 22° C. [cf. *R.A.M.*, v, p. 247] it was found that *Bacillus mesentericus vulgatus* and a bacterial spreader of the *proteus* type acted as 'inhibitors' to the growth of the following organisms: *Colletotrichum nigrum*, *Brachysporium* sp., *Helminthosporium gramineum*, *H. inaequalis*, *Physalospora cydoniae*, *Botrytis allii*, *B. paeoniae*, *B. tulipae*, *Rhizoctonia* from potato [*Corticium solani*], *Fusarium niveum* [ibid., xi, p. 558], *Thielavia basicola*, *Sclerotinia fructigena*, *Pythium de Baryanum*, *Cephalothecium* [*Trichothecium*] *roseum* [ibid., x, p. 321], and *Penicillium* sp. Both the 'inhibitors' also exercised their preventive effect at a distance on *Glomerella cingulata* and *Sclerotium rolfsii*, whereas *Basisporium gallarum* [*Nigrospora sphaerica*] was unaffected and continued to grow over the bacterial colonies. The development of the three last-named fungi was restricted to some extent by *Pseudomonas campestris* and that of *N. sphaerica* and *G. cingulata* also by *Bacillus carotovorus*.

ALBRECHT (W. A.) & JENNY (H.). **Available soil calcium in relation to 'damping off' of Soy Bean seedlings.**—*Bot. Gaz.*, xcii, 3, pp. 263–278, 4 figs., 6 graphs, 1931.

In some studies at Columbia, Missouri, on the effects of the soil calcium, as distinct from those of the hydrogen-ion concentration, on the inoculation with root nodule bacteria and growth of soybeans, 'damping-off' of the seedlings was prevalent notwithstanding thorough sterilization of the seeds and the media. The term 'damping-off' in this investigation refers to the dropping over of the young plants and other conspicuous symptoms, such as browning and flaccidity of the stems, associated with the disease usually designated by that name. No observations were made on the infecting fungi or internal plant structure.

The seedlings were grown in a mixture of quartz sand and calcium clay (obtained by separating out the colloidal fraction from

Putnam silt loam, purifying it by electrodialysis, and adding varying quantities of calcium hydroxide). Other calcium compounds (acetate and chloride) were used for comparison. In a series of experiments it was found that damping-off decreased as acidity decreased and calcium increased. Further tests showed that the hydrogen-ion concentration in itself was of minor importance in relation to the damping-off, which occurred in a severe form between $P_H$ 3·8 and 6·94 when the calcium supply was low but was absent when plenty of calcium was given. With an increasing calcium concentration the number of diseased plants declined rapidly both at $P_H$ 7 and 4·4, while at a high calcium concentration no damping-off occurred between $P_H$ 3·8 and 8. In another series of tests calcium ions were found to be superior to other mono- or divalent ions at equal concentrations. With potassium chloride the decrease in damping-off was from 94 to 74 per cent., with magnesium chloride from 96 to 12 per cent., and with calcium chloride (and also calcium acetate) from 89 to 0. The availability of the calcium is an important feature in its effect in controlling damping-off. Free, diffusible calcium ions were found to be more effective than adsorbed, exchangeable ones, while calcium bound by the forces of the crystal lattice in the mineral anorthite was ineffectual as a preventive.

SMALL (T.). **Prevention of blight in seed Potatoes.**—*Nature*, cxxx, 3279, p. 367, 1932.

Seed potatoes are usually dug in Jersey (Channel Islands) when the haulms are green. If blight (*Phytophthora infestans*) is present on the leaves at this time, serious losses (50 to 75 per cent.) may occur in the seed-boxes owing to the spores falling on the tubers. Experiments conducted at the States Experiment Station, Glenham, have shown that such losses may be almost entirely eliminated by dipping the 'seed' twice, soon after lifting, in a 1 per cent. dilution of formalin (1 pint in 99 pints of water) or in a neutral mixture of copper sulphate and caustic soda (4:1:40). There appears to be no reduction of sprouting as a result of this treatment.

Large-scale trials of this method are now in progress, the tubers being dug, placed in the seed-boxes, and dipped on the same day. Four men can unload, dip, and stack 360 boxes of 'seed' in one hour.

ADAM (D. B.). **Potato disease control: effects of seed treatment.**—*Journ. Dept. Agric. Victoria*, xxx, 9, pp. 455–461, 1 fig., 1932.

In recent experiments in the control of *Corticium vagum* [*C. solani*] on potatoes in Victoria, treatment with cold formalin solution (1 lb. to 30 galls. water) for 1½ hours resulted in an average increase of yield of 13 per cent., while a slightly smaller increase followed immersion in mercuric chloride (1 oz. to 6¼ galls.) for the same length of time. Preliminary tests with acidulated mercuric chloride (2 oz. to 6¼ galls. for 5 minutes) [*R.A.M.*, xi, p. 534] and germisan (2 oz. to 10 galls. for 15 minutes) gave results about equal to those obtained with the ordinary mercuric chloride treat-

ment. The acidulated mercuric chloride treatment is open to the objection of causing injury to the seed-potatoes under certain conditions. Formalin also may cause injury if used too strong on delicate seed stocks. The mercuric chloride solutions were found to be specially effective in reducing the incidence of 'collar rot' due to *C. solani*.

SALMON (E. S.). **Fifteenth report on the trial of new varieties of Hops.**—*Journ. Inst. of Brewing*, N.S., xxix, 10, pp. 464–469, 1932.

The following commercial hop varieties were infected by mosaic at the East Malling Research Station in 1931 [cf. *R.A.M.*, x, p. 127; xi, p. 745]: Canterbury, Petham, and Rodmersham Goldings, Mathon, Cobbs, Tutsham, Bramling, Extra Early Bird, and Old Jones (52 hills in all); and the following new ones: B12a, OF27, OR7, WI8, and OF76.

The observations on downy mildew [*Pseudoperonospora humuli*: ibid., xi, p. 471] are based on the records of F. H. Beard's periodical inspections of the gardens. The attack on the bines was fairly general, basal, terminal, and lateral spikes being very common. The first application of Bordeaux mixture (10–10–100) was given on 17th and 18th July, using about 400 galls. per acre. For the second (11th and 12th August) 250 galls. per acre were given. This treatment failed to protect the 'heads' of many of the bines, but the cones on the lower laterals remained quite free from infection. The crop of the OD99, OK27, and V46 varieties was so poor that it was not worth picking, while cone infection was severe on a number of other new varieties [a list of which is given].

HOERNER (G. R.). **Downy mildew infection of Hop seedlings.**—*Journ. Inst. of Brewing*, N.S., xxix, 10, pp. 470–471, 1932.

Both conidia and oospores of the hop downy mildew fungus (*Pseudoperonospora humuli*) were produced in abundance in and on the cotyledons and leaves of artificially inoculated hop seedlings of the Early and Late Clusters and Fuggles from Oregon, Late Clusters from California, East Kent Goldings from British Columbia, and Red Vines from Oregon [*R.A.M.*, xi, p. 602]. The inoculum was taken in part from the above-mentioned varieties and also from *Humulus lupulus* [var.] *neo-mexicanus*. The incubation period ranged from 1 to 14 days on the cotyledons and from 2 to 12 on the leaves. No positive indication of varietal resistance to the fungus was obtained. The fact that cross-inoculation was readily effected by the use of conidia from several different hosts appears to indicate that biologic forms of *P. humuli*, if they exist, are of rare occurrence.

RIVIER (A.). **Observations sur le Peronoplasmopara humuli.** [Observations on *Peronoplasmopara humuli*.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 4, pp. 168–169, 1932.

This is a record of the discovery in June, 1932, of downy mildew (*Peronoplasmopara* [*Pseudoperonospora*] *humuli*) [see

preceding abstracts] on hops at the École d'Agriculture, Montpellier. The fact that the disease had not been previously found in the south of France, and that no new hop planting material had been brought to Montpellier since its appearance in northern France, would indicate that the infection was carried by wind from far afield.

SALMON (E. S.). & WARE (W. M.). **The small Hop disease.**—*Journ. South-Eastern Agric. Coll., Wye, Kent*, xxx, pp. 22–27, 4 pl., 1932.

After describing several further cases (affecting, as before, single plants in various hop-gardens) of small hop disease, the symptoms of which closely resembled those previously observed [*R.A.M.*, ix, p. 15], the authors state that although gall formations or cushions of tissue resembling tumours might be present in proximity to or actually bear the buds, they do not now consider that the condition is due to crown gall [*Bacterium tumefaciens*]. The groups of buds appear each to be formed by the proliferation of a single original bud or shoot on the crown or on the basal nodes of the previous season's bines.

WEBER (G. F.). **Blight of Peppers in Florida caused by Phytophthora capsici.**—*Phytopath.*, xxii, 9, pp. 775–780, 4 figs., 1932.

During the winter of 1930–1, two pepper [*Capsicum annuum*] varieties in the Homestead area of Florida were attacked by blight (*Phytophthora capsici*), the symptoms of which differed in certain respects from those described by Leonian from New Mexico [*R.A.M.*, ii, p. 101; xi, p. 803].

Infection occurred on the stems, branches, fruit, and leaves. Diseased stems were often girdled at soil level, resulting in a sudden wilting and death of the whole plant. The lesions consisted of dark green, water soaked bands, later turning brown. In young plants the tops were also invaded and killed. The spots on the leaves were at first small, circular or irregular, and scalded in appearance; later they enlarged, bleached to a pale tan colour, assumed a papery consistency, and sometimes fell out. The fruit was infected through the peduncle from stem lesions, and developed a dark green, water soaked aspect. The conidia were produced on short conidiophores growing through the epidermis in compact clumps. Infected pods rapidly shrivelled and remained attached to the plant in mummied form.

Abundant oospores but relatively few sporangia were developed in culture. A comparative study of this organism and *P. parasitica* revealed constant differences between the two. When uninjured pepper plants were inoculated with a water suspension of the sporangia of *P. capsici* in the greenhouse and field, 54 per cent. of infection was obtained under the former conditions and 19 per cent. under the latter. On other plants inoculated with agar overgrown by mycelium, 100 per cent. infection developed. Inoculations with *P. parasitica* failed to cause the typical symptoms. Similar results were given by inoculations on the pods.

DAVIS (R. L.). **Report of the Plant Breeder.**—*Rept. Porto Rico Agric. Exper. Stat., 1931*, pp. 13–22, 2 figs., 1932.

In breeding trials against sugar-cane mosaic carried out during 1931 in Porto Rico [cf. *R.A.M.*, x, p. 340; xi, p. 540] some 400 inbred seedlings of Kassoer U.S. 785 were obtained from Las Mesas in order to secure for breeding stock a prolific, high-sucrose, immune variety.

The crosses between P.O.J. 2725 and the inbred Kassoer seedlings, U.S. 785 and U.S. 541, gave several seedlings equal in sucrose content to first-year 'noble cane' seedlings. Seedlings from U.S. 541 pollinated with S.C. 12/4 were highly resistant. Several seedlings of P.O.J. 2725 and B.H. 10(12) also appeared to be resistant [ibid., ix, p. 132]. The outstanding progeny of the second-year seedlings was that of the cross between Mayaguez 28 and P.O.J. 2878; of 25 seedlings of this combination under trial, only one appeared to be very susceptible, the majority being resistant.

Notes made on the first ratoons of the mosaic-elimination plot of the P.O.J. 2364 and Mayaguez 9 seedlings confirmed the previous year's results, indicating that most of the 71 seedlings under trial are either highly resistant or immune.

The apparent immunity or so-called 'commercial resistance' (i.e., resistance high enough to render roguing inexpensive or unnecessary) of Mayaguez seedlings 3, 7, and 42 [P.O.J. 2725 × S.C. 12/4] is now well established; nos. 13, 52, and 83 are apparently immune. Mayaguez 28, 44, 49, 61, and 63 continued as in previous years to show only negligible amounts of mosaic, with the result that very little difficulty is anticipated in keeping the fields rogued. Preliminary field trials indicated that Mayaguez seedlings 7, 42, and 63 will compete successfully with B.H. 10(12) in sugar production. The area planted with Mayaguez seedlings increased from 73 acres in 1930 to over 600 in 1931.

DAVIS (R. L.). **Mayaguez 28, 49, and 63, three Sugar Cane varieties commercially resistant to mosaic.**—*Agric. Notes, Porto Rico Agric. Exper. Stat., Mayaguez*, 61, 6 pp., 1932. [Mimeographed.]

In this progress report of breeding work against sugar-cane mosaic in Porto Rico [see preceding abstract] carried out during 1931 and 1932, full details are given of the characters of the Mayaguez seedlings 3, 7, 28, 42, 49, and 63, and of the trials that were made with them. The most promising seedlings appeared to be Mayaguez 28, 63, and 42 (in descending order of merit). Mayaguez 28, 49, and 7 are recommended for either upland or non-irrigated lowland trials and Mayaguez 28, 3, 42, and 63 for irrigated lowland. Of all these varieties, Mayaguez 28 appears to be the most adaptable, having given satisfactory results on sandy alluvial lowland and on dry hillsides.

MARTIN (J. P.). **Field control of mosaic disease in Hawaii.**—*Proc. Fourth Congr. Internat. Soc. Sugar Cane Technologists*, 1932. [Abs. in *Facts about Sugar*, xxvii, 8, p. 365, 1932.]

Mosaic of sugar-cane in Hawaii is stated to be now serious only

in a few localized areas and on a small number of highly susceptible varieties [*R.A.M.*, xi, p. 539]. In the field rigid selection of healthy cuttings for seed is practised, so that newly planted fields may be kept almost free from the disease. Cane knives are known to transmit the virus and require frequent disinfection. The most efficacious of all control measures is the replacement of susceptible (e.g., Striped Tip) by resistant varieties, such as D. 1135. Other important means of combating mosaic include systematic roguing and clean cultivation, the latter involving the exclusion from the plantations of any hosts of the maize aphid [*Aphis maidis*].

BELL (A. F.) & COTTRELL-DORMER (W.). **Method for isolating the leaf scald organism.**—*Proc. Fourth Congr. Internat. Soc. Sugar Cane Technologists*, 1932. [Abs. in *Facts about Sugar*, xxvii, 8, p. 365, 1932.]

The isolation of *Phytomonas* [*Bacterium*] *albilineans*, the causal organism of leaf scald of sugar-cane [*R.A.M.*, xi, pp. 403, 539, 604], is difficult on account of its slow rate of growth and the necessity for heavy sowing. The writers have found that the organism thrives better in a medium in which it has already grown than in a fresh portion of the same medium. The bacterium is accordingly sown in a large quantity of Wilbrink's agar, and after sufficient growth has been made the entire batch is pasteurized and then used as a medium for investigating the lesions of plants suspected of leaf scald. The preparation and maintenance of large quantities of the agar present certain inconveniences which may be overcome by incorporating 0·005 per cent. sodium sulphite with the ordinary Wilbrink's medium.

ABBOTT (E. V.). **Cytospora sacchari on Sugarcane in Louisiana.** —*Plant Disease Reporter*, xv, 14, p. 160, 1931. [Mimeographed. Received December, 1932.]

*Cytospora sacchari* [*R.A.M.*, ix, p. 808] was of fairly common occurrence on sugar-cane in Louisiana during 1931, the fungus having been collected in the autumn of 1930, apparently for the first time in the United States, on the Co. 281 variety. It is stated to be of little or no economic importance.

COOK (M. T.). **Thielaviopsis paradoxa an important disease of Sugar Cane. Marasmius sacchari a parasite on Sugar Cane.** —*Journ. Dept. Agric. Puerto Rico*, xvi, 2, pp. 205–226, 5 pl., 1932.

The writer's observations on the importance of *Thielaviopsis* [*Ceratostomella*] *paradoxa* as a cause of poor germination of seed cane in Porto Rico have already been summarized from another source [*R.A.M.*, xi, p. 542]. Attention is here drawn to the variable extent of the losses in different years, depending on local conditions.

Of recent years plants have frequently been observed making poor growth, the lower leaves being dead and bound together and to the base of the plant by a white mycelial weft extending both above and below soil level. Sometimes the young canes were killed and the roots were generally in bad condition. The fungus,

*Marasmius sacchari* [ibid., xi, p. 674], was readily isolated from diseased plants and grew well in culture. Sterile pieces of cane 2 in. long bearing one bud were grown in glass cylinders and inoculated with the fungus grown on sterilized cane plugs. The organism attacked any part of the shoot with which it came into contact, penetrating and completely covering the smaller ones and preventing the buds from sprouting. Young shoots were more rapidly destroyed than older ones. Young plants grown in sterilized soil and inoculated by pushing infected cane plugs down into the soil beside them, were dwarfed but not killed. A mass of mycelium was also formed over the surface of the leaves and between them. The fungus was detected in all the cells of young plants except those with very thick, hard walls such as are found in the vascular bundles, while even the latter may be penetrated when the inoculated plugs are placed in contact with the tip of the young cane. In infected roots the mycelium was found from the centre of the pith to the epidermis.

It is evident from these results that *M. sacchari* is a vigorous parasite of growing canes. The decay due to this organism, however, is slower than that caused by *C. paradoxa*.

SHEPHERD (E. F. S.). **A preliminary list of plant diseases occurring in Mauritius.**—*Mauritius Dept. of Agric. Bull.* 18, Sci. Ser., 8 pp., 1932.

An annotated list, arranged in alphabetical order of hosts, is given of the bacterial, fungous, virus, and physiological diseases affecting fruit, vegetables, sugar-cane, tea, tobacco, grasses, and ornamental and miscellaneous plants in Mauritius.

MENDOZA (J. M.). **New or noteworthy Philippine fungi. II.**—*Philipp. Journ. of Sci.*, xlix, 2, pp. 185–196, 9 pl., 1932.

Continuing his studies on the sooty moulds of the Philippines [*R.A.M.*, xi, p. 547], the writer describes (with Latin diagnoses) four new species of *Asterina*, and one each of *Asterinella*, *Asteromyxa*, *Aithaloderma*, and *Chaetothyrium*. *Aithaloderma fici* n. sp., found forming a sooty mould on *Ficus* leaves in Luzon, Batangas Province, and elsewhere, resembles *A. setosum* [ibid., x, p. 559] in many respects but differs from the latter in its stout sagittate setae. *C. muriformis* n. sp. forms a sooty mould on the leaves of *Codiaeum variegatum* in various localities.

MARTIN (G. W.). **Systematic position of the slime molds and its bearing on the classification of the fungi.**—*Bot. Gaz.*, xciii, 4, pp. 421–435, 1932.

The origin and development of the Myxomycetes or slime moulds is discussed in the light of modern research as well as in that of the older interpretations, and the differences between this group and the Phycomycetes are critically examined. In the writer's view, these differences are neither so absolute nor so fundamental as to necessitate a greater separation than may be admitted between two classes of the same phylum. It is suggested that the fungi be regarded as a monophyletic group, but one which has not definitely developed into either plants or animals, though

it may be classified with the former for the sake of convenience and in accordance with custom. The Myxomycetes would then form a natural class, the lowest of four, the others being the Basidiomycetes, Ascomycetes, and Phycomycetes.

HUMPHREY (C. J.) & LEUS-PALO (SIMEONA). **Studies and illustrations in the Polyporaceae, III. Supplementary notes on the Ganoderma applanatum group.**—*Philipp. Journ. of Sci.*, xlix, 2, pp. 159–184, 11 pl., 1932.

Since their preliminary revision of the *Ganoderma applanatum* group of the Polyporaceae [*R.A.M.*, xi, p. 10], the authors have examined several of the older types of this group from the Kew Herbarium and the Paris Museum. The results of these studies have confirmed the opinions previously advanced as to the taxonomy of the organisms represented.

In view of the different interpretations given to *G. australe* [ibid., vii, p. 406], and the lack of satisfactory authentic material for comparative purposes, it is considered advisable to discontinue the use of this name. *G. tornatum* and *G. testaceum* are regarded as varieties of *G. applanatum*, and *G. subtornatum* as a form of *G. mastoporum*.

PALM (B. T.). **On Cyttaria Berk. and Cyttariella n. gen.**—*Ann. Mycol.*, xxx, 5–6, pp. 405–420, 4 figs., 1932.

Taxonomic notes, supplemented by a key, are given on four species of *Cyttaria*, namely, *C. darwini*, *C. harioti*, *C. hookeri*, and *C. intermedia* n. sp., all on *Nothofagus* sp., collected in part by Dr. C. Skottsberg in Tierra del Fuego during 1901–03 and supplemented by material supplied by Dr. O. Borge from southern Patagonia.

A small, *Cyttaria*-like pycnidial fungus growing as a parasite on the younger twigs of *N. betuloides* in Tierra del Fuego is named *Cyttariella skottsbergii* n.g., n. sp., with Latin diagnoses. The piriform or clavariiform, erumpent stromata are yellow or dark externally and white within; the pycnidia occur in the flattened top of the stroma, from which the numerous (10 to 25) minute ostioles protrude, and are 200 to 300 $\mu$ in diameter. The interior of the pycnidium is uniformly lined with short, blunt, hyaline sterigmata up to 20 $\mu$ long, bearing hyaline conidia, 4 by 2 $\mu$ in diameter. *C. skottsbergii* differs from *C. deformans* (Bomm. & Rouss.) comb. nov. (*Podocrea deformans* Bomm. & Rouss.) chiefly in the pycnidia being found all over the stroma in the latter, as well as in the size and colour of the stromata. The mycelium of *C. skottsbergii* forms ligneous tumours on the twigs of its host, in which the woody and cortical elements are hypertrophied. In this it resembles the description of *C. deformans* given by Bommer and Rousseau.

DONANDT (S.). **Untersuchungen über die Pathogenität des Wirtelpilzes Verticillium alboatrum R. u. B.** [Investigations on the pathogenicity of the whorl fungus *Verticillium alboatrum* R. & B.]—*Zeitschr. für Parasitenkunde*, iv, 4, pp. 653–711, 4 figs., 5 graphs, 1932.

An exhaustive account (preceded by a discussion of the more

important relevant literature) is given of the writer's cross-inoculation experiments with *Verticillium albo-atrum* isolated from tomato, *Chrysanthemum morifolium*, eggplant (U.S.A.), *Papaver bracteatum*, lime (*Tilia parvifolia*), *Acer negundo*, elm (*Ulmus montana*), cherry, red currant, gooseberry, horse-chestnut, and plum, and with *V. albo-atrum* var. *caespitosum* [*R.A.M.*, ix, p. 6] from Frühe Rosen potato and var. *medium* [loc. cit.] from imported banana leaves. Except where otherwise stated, all the isolations were from German material. The following additional hosts were used in the inoculation experiments: elm (*U. campestris*), cherry (*Prunus mahaleb*), pepper (*Capsicum annuum*), *Physalis alkekengi*, and cotton (*Gossypium herbaceum*).

No indication of biologic specialization was afforded by these tests, the outcome of which showed that all the strains are capable of infecting each of the hosts (with the possible exception of elm), though with varying degrees of virulence. The most virulent strains for the herbaceous plants were those from potato, tomato, eggplant, and banana in the order named, while the woody plants were most severely infected by the currant and horse-chestnut isolations. From the very low incidence of infection produced on the elm it seems probable that this tree would ordinarily remain immune. Bewley's observation as to the inherent superiority of sclerotial over asclerotial strains of *V. albo-atrum* from the pathogenic standpoint [ibid., ii, p. 150] could not be confirmed by these tests.

A study of the influence of nutrition on the host and its consequent reactions to the fungus showed that in plants receiving insufficient nitrogen the parasite is restricted to the stem bases. With a moderate nitrogen supply penetration of the tops may be effected, but typical symptoms of infection are not apparent. Plentiful applications of nitrogen, on the other hand, lead to vascular obstruction, wilting, yellowing, and premature decay.

CASTELLANI (A.). **A new variety of Geotrichum matalense (Geotrichum matalense var. chapmani.)**—*Journ. Trop. Med. & Hygiene*, xxxv, 18, pp. 278–279, 3 figs., 1932.

An investigation of the fungus found by A. Chaston Chapman obstructing a London sewer in 1928 [*R.A.M.*, ix, p. 274] showed that it is very similar to *Geotrichum* (*Oidium*) *matalense*, encountered by the author in Ceylon in 1914.

The sewer organism, which is named *G. matalense* var. *chapmani*, is characterized by numerous septate hyphae, 1 to 4 $\mu$ in width, and by oblong or spherical, thick-walled arthrospores, 7 to 9 $\mu$ in length as compared with 4 to 7 $\mu$ for *G. matalense*. The biochemical characters of both fungi are practically identical, glucose, levulose, glycerol, arabinose, and xylose being fermented and litmus milk turned alkaline.

VALLEAU (W. D.) & JOHNSON (E. M.). **Tobacco diseases in Kentucky.**—*Kentucky Agric. Exper. Stat. Bull.* 328, pp. 109-154, 24 figs., 1932.

In this bulletin, which is stated to be the outcome of ten years' study at the Kentucky Experiment Station, brief and well-

illustrated accounts are given of the chief physiological, parasitic, and virus diseases of tobacco in the field, and of the trouble in the curing house locally known as houseburn, which is stated to be caused by the activity of fungi and bacteria in over-moist conditions at temperatures between 60° and 100° F. This is preceded by brief recommendations for the control of the diseases, applicable to Kentucky conditions. Most of the information given has already been noticed from time to time in this *Review*.

THUNG (T. H.). **Phytopathologische waarnemingen.** [Phytopathological observations.]—*ex* Jaarverslag 1 Mei 1931–30 April 1932.—*Proefstat. Vorstenlandsche Tabak, Meded.* 76, pp. 30–51, 3 figs., 1 diag., 1932.

A new form of tobacco mosaic (first observed in 1929) developed on two plantations in the Vorstenland, Java, during the period under review and caused heavy damage. The diseased plants had very small and irregularly shaped leaves and produced scarcely any that could be harvested. The sap of plants suffering from this type of mosaic appears to be much less virulent than that of the ordinary form, and it is probable, therefore, that infection spreads from plant to plant in the seed-bed instead of being transmitted in the usual way by coolies during the handling of the plants some two months after transplanting.

A reduction of yield due to *Phytophthora* [*parasitica nicotianae*: *R.A.M.*, xi, p. 750] was observed in tobacco plots following katjang tjina [groundnut] but not after rice. Slime disease [*Bacterium solanacearum*] was not detected, but it is pointed out that this organism can lead to a diminished crop without producing any external symptoms. During 1928–9 slime disease occurred in a very severe form in another plantation following groundnuts, and in 1931 it was still present though less extensive.

Mildew (*Oidium tabaci*) [*Erysiphe cichoracearum*: ibid., xi, p. 333] was little in evidence, probably because the tobacco crop was planted late and the rains washed away the spores of the fungus before they could be disseminated. An increase in the amount of sulphur ordinarily used for strewing the ground against this disease was found to impair the quality and burning capacity of the tobacco.

On some estates it was necessary to harvest early in order to avoid the white spotting and shot hole of the leaves caused by *Cercospora nicotianae* [ibid., xi, p. 477], which was further responsible for much damage in the curing barns. The incidence of infection was considerably reduced in the seed-beds by regular applications of Bordeaux mixture at 5-day intervals, the average number of spots in each of three treated beds containing 900 seedlings being 337 compared with 4,895 in the controls.

HOLMES (F. O.). **Movement of mosaic virus from primary lesions in Nicotiana tabacum L.**—*Contrib. Boyce Thompson Inst.*, iv, 3, pp. 297–322, 2 figs., 4 graphs, 1932.

Full details are given of the author's study of the movement of the tobacco mosaic virus from inoculated leaves of a Turkish variety, using the iodine method of detection [*R.A.M.*, xi, p. 333].

The length of time (4 to 10 days, mostly 6) between inoculation and the appearance of the first systemic symptom, viz., clearing of the veins, was found to be dependent on the number of primary lesions, which ranged from one to over 100 according to the method of inoculation. In old plants, the movement of virus to the top took place earlier when all the expanded leaves except the one inoculated were removed than when all were allowed to remain on the plant. Tissues towards the base of a leaf appeared to be more readily infected by pin puncture inoculation, and more capable of permitting early movement of virus from the leaf than those near the apex. The first indications of vein clearing commonly developed near noon, more rarely during the late afternoon, night, or early morning.

A great many unilateral infections were caused by shading the inoculated leaf in each plant, the results indicating that the distribution of the virus to the top of the plant can be modified by shading appropriate portions of leaf surface in the lower part of the plant. It is suggested that shading reduced the food supply to the growing parts from the inoculated leaf and the results might be explained by assuming that the virus travelled with the food supply.

The movement of the virus to the top of the plant was slightly delayed by cutting through the large veins between the site of inoculation and the petiole, and, when the large veins were thus prevented from conducting the virus, evidence was obtained that the latter was transported along the smaller veins to reach uncut large ones. Except in such experiments no extensive invasion of the small veins took place. When interveinal tissues alone were cut there was much less delay in the passage of the virus. Rapidity of movement of the virus was correlated with rapidity of growth of the inoculated leaf.

HOLMES (F. O.). **Symptoms of Tobacco mosaic disease.**—*Contrib. Boyce Thompson Inst.*, iv, 3, pp. 323–357, 8 figs., 1 graph, 1932.

A description is given of some variations of the usual symptoms of common tobacco mosaic (Johnson's virus 1) [see preceding abstract], and of other effects hitherto overlooked, such as prolonged yellowing, occurring in *Nicotiana quadrivalvis*, *N. multivalvis*, *N. clevelandii*, and certain chilli pepper varieties; leaf abscission in *Physalis peruviana* and some chilli varieties; flower and fruit drop in chilli and *N. quadrivalvis*; outgrowths of tissue ['enations'] on the lower side of mottled leaves in *N. tomentosa* and *N. paniculata* [*R.A.M.*, xii, p. 58]; systemic necrosis in young plants of *N. rustica*, *P. angulata*, Black Beauty eggplant, Green Mountain potato, and chilli; failure to remove chlorophyll from the secondary lesions on old leaves of *Nicandra physaloides*, *Lycium ferocissimum*, and chilli; bending of the upper stem towards the side of the plant bearing an inoculated leaf in *Nicotiana rustica*; and intensification of pigment in the spots on flowers of *Nicandra physaloides*.

Certain hosts of tobacco mosaic belong to the group of completely or almost completely symptomless carriers, e.g., the

Hangchow Long eggplant, *P. alkekengi*, *Nicotiana glauca*, and the red currant tomato (*Lycopersicum pimpinellifolium*), in which an increase of virus occurs in the inoculated organs without any corresponding external effect. The inoculation of *Petunia* varieties and *Martynia louisiana* with tobacco mosaic causes a reaction resembling that of Turkish tobacco, *Nicotiana sylvestris*, *N. longiflora*, *N. rusbyi*, *N. suaveolens*, and *N. palmeri* (pronounced mottling and foliar distortion). *N. trigonophylla*, tomato, and *Solanum nigrum* are similarly but less severely affected, while the Long White and Peking Green eggplant develop an obscure mottling which may almost disappear and leave the plants as symptomless carriers. *Hyoscyamus niger* becomes severely stunted and yellowed after clearing of the veins. Localized necrosis of various types occurs in *N. glutinosa*, *N. alata*, *N. sanderae*, *N. acuminata*, *N. langsdorffii*, *Datura stramonium*, Black Beauty eggplant, and beans (*Phaseolus vulgaris*) [ibid., ix, p. 810] inoculated with this virus.

The enations developing as a result of inoculation on *N. tomentosa* and *N. paniculata* occur on the lower surface in areas that fail to expand normally, and may be a quarter of an inch or more in height. They have not been seen on healthy plants but appear sooner or later on all the inoculated ones.

PRICE (W. C.). **Acquired immunity to ring-spot in Nicotiana.**—*Contrib. Boyce Thompson Inst.*, iv, 3, pp. 359–403, 7 figs., 2 graphs, 1932.

The symptoms of ring spot (obtained from Wingard) in Turkish tobacco [*R.A.M.*, xi, p. 406] were found in the writer's experiments to vary with the environmental conditions. Inoculated plants kept in darkness develop water soaked, necrotic spots, and eventually succumb to the disease. Those grown under humid conditions develop lesions consisting of many more concentric rings than when the plants are kept dry.

More or less complete recovery from ring spot occurred in all the plants tested of *Nicotiana langsdorffii*, *N. sylvestris*, *N. multivalvis*, *N. quadrivalvis*, and the following varieties of *N. tabacum*: Turkish, Burley, Little Orinoca, *auriculata*, *purpurea*, *angustifolia*, *calycina*, *colossea*, *gigantea*, and *macrophylla*. The juice from all the recovered plants tested was found to be still highly infectious and produced similar symptoms in healthy tobacco plants to those given by inoculation with the virus from severely diseased individuals. No symptoms developed on recovered plants as a result of further inoculation with the ring spot virus, which suggests that immunity can be acquired as a result of infection. In experiments in which the stem tips were kept defoliated until the virus had reached the young tip bud, the plants thus treated acquired immunity from ring spot without ever showing symptoms of the disease. It was found that immunity in Turkish tobacco persisted for three generations in plants grown from cuttings but was not transmitted through the seed to any of the 825 seedlings tested. Grafting experiments gave no evidence that acquired immunity in Turkish tobacco is accompanied by the production of antibodies.

Some plants that fail to make a complete recovery show mild symptoms readily distinguishable from those of the early stage of acute infection. They consist merely of mild chlorotic or necrotic symptoms on the margins and tips of a few leaves, sometimes extending irregularly into the midrib.

Inoculation experiments with the ring spot virus gave positive results on a number of bean (*Phaseolus vulgaris*) varieties, Lima and var. *sieva* of *P. lunatus*; three varieties of *P. lunatus* var. *macrocarpus*; and four of cowpeas. Systemic symptoms in the form of circular, necrotic spots on the young leaves and irregular, reddish lesions on the stems and leaf petioles, developed on some of the bean and cowpea varieties and eventually caused the death of the plants.

STEVENS (N. E.) & NANCE (NELLIE W.). **Spoilage of Tomatoes in transit, as shown by inspection certificates, 1922 to 1930.**—*U.S. Dept. of Agric. Circ.* 245, 4 pp., 1932.

A summary is given, based on an analysis of the data obtained in regular carload inspections, of the principal diseases affecting tomatoes in transit from California, Florida, Mississippi, Tennessee, Texas, and Mexico. These include *Rhizopus nigricans*, *Phoma destructiva* [*R.A.M.*, xii, p. 24], *Bacillus carotovorus*, *B. aroideae*, and other agents of soft rot, *Corticium vagum* [*C. solani*], blossom-end rot, buckeye (*Phytophthora terrestris*) [*P. parasitica*], *Colletotrichum phomoides* [ibid., x, p. 439], *Fusarium lycopersici*, late blight (*P. infestans*), and nailhead (*Macrosporium*) [*Alternaria tomato*: ibid., xi, p. 771]. The total incidence of decay in the 3,132 carloads inspected from 1923 to 1926 was 10 per cent., the corresponding figures for 1927 to 1930 being 8 per cent. in 5,321 carloads.

WARDLAW (C. W.) & MCGUIRE (L. P.). **The storage of tropically-grown Tomatoes.**—*Empire Marketing Board Publ.* 59, 50 pp., 9 graphs, 1932.

Investigations conducted at the Low Temperature Station, Trinidad, into the cold storage of tropically grown tomatoes showed that nearly all the active fungal wastage that occurred was sustained after the fruit had been removed from cold storage to the ripening room at 70° F. Except for the occasional presence of soft rot (*Bacterium* [*Bacillus*] *aroideae*) [*R.A.M.*, x, p. 610] few infections developed on selected fruit stored at 45°, 47·5°, or 50°. In one lot of rejected fruit the decay was due chiefly to soft rots associated with species of *Phomopsis* and *Fusarium*, but in two other lots in later trials the rejections were due chiefly to the spotting caused by *Phoma destructiva* [see preceding abstract]. *Alternaria solani* was usually present on infections where the skin showed a dark, leathery discoloration, while *Glomerella cingulata* was associated with a soft rot. Spotting and soft rots (the main sources of wastage) occurred either in conjunction with cracks and bruises, or at the insertion of the style or the button, or as isolated infections distributed over the surface of the fruit. The proportion of button to other infections was usually high, especially after

long storage (14 to 17 days) and when the fruit was kept at the higher temperatures.

At temperatures below 47·5° the characteristic tomato pathogens showed greatly retarded growth or none. As this temperature does not unduly delay maturation it is a suitable one for the storage of Trinidad-grown tomatoes.

HORSFALL (J. G.). **Dusting Tomato seed with copper sulfate monohydrate for combating damping-off.**—*New York (Geneva) Agric. Exper. Stat. Tech. Bull.* 198, 34 pp., 3 figs., 4 graphs, 1932.

This is a detailed account of experiments in 1930–31 on the efficacy of seed disinfection with copper compounds in the control of tomato seedling damping-off caused by *Pythium ultimum* [*R.A.M.*, xi, p. 408]. The results (which were also subjected to statistical tests) showed that dusting the seed with monohydrated copper sulphate was more effective than either copper carbonate dust or steeping the seed in copper sulphate solution in protecting the seedlings against attacks by the fungus before their emergence; after their emergence, however, the incidence of the disease was least on those raised from seed steeped in copper sulphate, next in those raised from seed dusted with monohydrated copper sulphate, and highest in the copper carbonate lot. Dilution of the monohydrated copper sulphate with three volumes of kaolin did not appear to reduce its efficacy. Anhydrous copper sulphate dust was equally efficient, and adhered somewhat better to the seed, but is not recommended for general practice because of its higher cost. It was shown that 1 lb. of tomato seed thoroughly dusted with monohydrated copper sulphate retains 0·6 oz. of the dust.

The experiments also established that none of the copper compounds tested is toxic to the tomato seedlings, and that steeping the seed for as long as two hours in a saturated solution of copper sulphate not only did not reduce the stand of the seedlings but stimulated their growth and vigour in infected soil; in steamed soil, however, this treatment retarded the emergence of the seedlings by two days on the average, and had a slightly depressing effect on their health.

In a theoretical discussion of the phenomena involved in the attack on the host roots by soil-borne organisms, the author suggests the term 'inoculum potential' to describe the effect of the content of the soil in infective material on the severity of infection, independently of the environmental factors. A brief description is included of a relatively inexpensive autoclave for experimental soil sterilization.

CHAMBERLAIN (E. E.). **Tomato leaf-mould (Cladosporium fulvum).**—*New Zealand Journ. of Agric.*, xlv, 3, pp. 136–142, 2 figs., 1932.

After a brief account of the life-history of the tomato leaf mould fungus (*Cladosporium fulvum*) [*R.A.M.*, xi, p. 679], the author states that it is one of the most troublesome diseases of the crop under glass in New Zealand, and gives an outline of the conditions that favour its appearance and development, as well as of

the cultural measures calculated to prevent it. For direct control the local growers are recommended to spray the tomato plants with colloidal sulphur, keeping in view the fact that timely application is more important than the strength of the spray. If the disease appears early in the season, fortnightly applications are advised, but later on the intervals may be extended to three weeks. The glasshouses should be thoroughly disinfected before the new crop is planted, preferably by fumigating them with formaldehyde or sulphur dioxide.

RUPPRECHT (G.). **Schwefelnebel gegen die Braunfleckenkrankheit der Tomaten.** [Sulphur mist against the leaf mould disease of Tomatoes.]—*Obst- und Gemüsebau,* lxxviii, 10, p. 160, 1932.

The writer's experience agrees with that of Small as regards the failure of sulphur fumigation in the control of tomato leaf mould (*Cladosporium fulvum*) once the disease is established [*R.A.M.*, xi, p. 211], but by the use of the new sulfurator apparatus [ibid., xi, p. 254] the development of the fungus may be prevented. It is pointed out that the temperature of the greenhouse to be fumigated should not exceed 40° C., above which point the fungicidal pentathionic acid generated by the sulphur in sunlight at 25° and over [ibid., xi, p. 465] is liable to burn the plants. The sulfurator has also given good results in the prevention of apple mildew [*Podosphaera leucotricha*] in the Hamburg district.

FINLAYSON (E. H.). **Report of the Director of Forestry 1930–31 (fiscal year ended March 31, 1931).**—*Dept. of the Interior, Canada,* Ottawa, F. A. Acland, 19 pp., 1932.

This report contains, *inter alia,* the following items of phytopathological interest. The *Septoria* canker of poplars [*R.A.M.*, xi, p. 137] has been found to occur with equal severity on trees of Russian, Northwest, and Saskatchewan origin. The fungus enters the stem through wounds but cannot penetrate healthy bark; its incubation period is seven weeks.

In order to prevent fungous rots, wooden poles were placed in tin containers filled with preservative salts, e.g., zinc chloride and copper sulphate. The salts are dissolved by moisture trickling down the poles, and during dry weather the evaporation of moisture from the upper part draws the solution upwards until the pole is impregnated to within a few inches of the top. After a few years' service, however, the parts of the pole just above and below ground level require a brush treatment with creosote [ibid., xii, p. 1].

Tests of red-stained jack pine [*Pinus banksiana*] showed that of the two fungi causing this defect, viz., *Trametes pini* and an unnamed organism, the former may reduce the strength values by up to 75 per cent. while the corresponding loss due to the latter is under 10 per cent.

*Torula ligniperda* [ibid., xi, p. 137] was found to be producing 'red heart' in birch.

Harris (H. A.). **Initial studies of American Elm diseases in Illinois.**—*Bull. Illinois Dept. Registr. & Educ., Div. Nat. Hist. Survey*, xx, Art. 1, 70 pp., 32 figs., 3 diags., 1932.

Elm trees in Illinois have long been affected by a number of pathological conditions, collectively known as 'wilt', of which the general symptoms are the presence of dead limbs, usually near the top; blighting of the twigs on one or more branches; and wilting of the leaves. On closer inspection cankers of widely varying appearance and dimensions may be found on the diseased limbs. Affected trees frequently retain their dead foliage for some time after normal leaf abscission. Elm 'wilt' is stated to have caused very heavy losses among nursery trees since its detection in 1925.

From some 200 specimens of diseased material the writer made 512 isolations yielding 20 genera of fungi, chiefly *Alternaria* (23·44 per cent. of the total number) and *Coniothyrium* (16·21), the latter being the outstanding cause of destructive wilting while *Alternaria* is a chance inhabitant of the bark, not producing serious disease. The *Coniothyrium* apparently enters the trees through the young, growing shoots at the tips of the branches, as the leaves are unfolding. Those nearest the site of invasion turn yellow and shrivel, and as infection progresses downwards, more leaves are killed and the tips curl in the shape of a shepherd's crook. The leaves of diseased trees are few, and small. Sunken, water soaked, reddish- to greyish-brown or dark purple cankers appear on the infected branches, completely girdling the young shoots and twigs. The wood of diseased stems shows a marked light to darkish brown, diffuse discoloration. The cortical and phloem tissues are extensively disorganized by the inter- and intracellular mycelium, the cambium is destroyed, and tracheomycosis develops in the xylem. Gummosis is a common symptom of *Coniothyrium* infection, which usually kills the trees within two or three years. Two types of the fungus, *A* and *B*, distinct in morphological and cultural characters, were isolated from diseased material. The former is characterized by spherical to subglobose, dark brown pycnidia, 95 to 350 $\mu$ in diameter in nature and up to 476 $\mu$ in agar cultures, producing unicellular, olivaceous, oval or spherical to oblong pycnospores, 3·6 to 7·3 by 2·9 to 5·8 $\mu$ (mostly 5·1 to 5·8 by 3·6 to 5·1 $\mu$). The pycnidia of *B* are dark brown, spherical, 60 to 272 $\mu$ in diameter, and produce subhyaline to brown, unicellular, ovoid-oblong to short elliptical pycnospores, 2·5 to 6·6 by 1·4 to 4·4 $\mu$ (mostly 3·6 to 4·4 by 1·4 to 2·2 $\mu$). Both forms differ from *C. ulmi*, a parasite of *Ulmus campestris* in America, and the *B* type is thought to be probably distinct also from *C. fuckelii* [*Leptosphaeria coniothyrium*], though *A* somewhat resembles the latter.

A species of *Vermicularia* obtained from 1·36 per cent. of the total number of isolations, causes extensive defoliation and destruction, without cankers, of the branches of mature shade trees, accompanied by a dark brown, streaky internal discoloration of the wood. It is characterized by dark brown, globose, setose pycnidia, 40 to 122 $\mu$ in diameter (average 80 to 95 $\mu$), and hyaline, unicellular, oblong, short elliptical, or bacilliform pycnospores, 1·8 to 3·6 by 0·7 to 1·4 $\mu$ (mostly 2·2 to 2·9 by 1·4 $\mu$).

Two distinct cultural strains of *Phoma* (*A* and *B*) were found to cause thickened, raised, smooth cankers and a diffuse discoloration of the cortex and wood (3·71 per cent. of the total isolations), the colonies of the former on maize meal agar being dendritic with a dark brown mycelium and tufted, greyish hyphae, while those of *B* are concentrically zonate with a pale olivaceous to yellowish-brown mycelium. Both strains possess flask-shaped to globose pycnidia, 120 to 275 $\mu$ in diameter (average 135 to 150 $\mu$), and hyaline, unicellular, bacilliform, biguttulate pycnospores, 1·8 to 4·4 by 1·1 to 4 $\mu$ (mostly 2·9 by 1·4 to 1·8 $\mu$). A third type was isolated from four trees, in conjunction with an *Alternaria* and appears to resemble *P. alternariaceum* [*P. conidiogena*] [*R.A.M.*, vi, p. 241; xi, p. 374].

Trees attacked by *Sphaeropsis* [or *Botryodiplodia*] *ulmicola* [ibid., xi, p. 212], which occurred in 2·15 per cent. of the isolations, assume a stag-headed appearance due to the early death of the top branches, below which secondary shoots are often formed, giving a witches' broom effect. Reddish-brown to brownish-black cankers develop on the stem and the discoloration extends to the underlying cambial area and wood. The scattered, erumpent pycnidia are 200 to 300 $\mu$ in diameter, and the ellipsoid to obovate, yellowish-brown conidia, 20 to 30 by 12 to 15 $\mu$.

The canker-forming *Phomopsis* [cf. next abstract] observed in a few cases produces both the oval $\alpha$ and the slender, curved $\beta$ spores [ibid., x, p. 279], and agrees fairly well with that found in Holland [ibid., viii, p. 206; ix, p. 5; cf. also xi, p. 212]. The $\alpha$ spores of the Illinois species measure 5·8 to 11·7 by 1·8 to 3·3 $\mu$ (mostly 7·3 to 8·8 by 2·2 to 2·5 $\mu$) and the $\beta$ 23·2 by 1 $\mu$.

Notes are also given on the following organisms associated with elm wilt: *Verticillium albo-atrum* [ibid., x, p. 633 and above, p. 116], *Fusarium scirpi* var. *compactum*, *F. oxysporum*, *Cephalosporium* spp. *Anthostomella* sp., *Cytospora* (?) *ambiens*, *Diplodia ulmi* (Dearness's diagnosis of which is amended as regards spore dimensions), *Nigrospora sphaerica* [ibid., vi, p. 758 *et passim*] and several other, possibly saprophytic forms.

RICHMOND (B. G.). **A Diaporthe canker of American Elm.**—*Science*, N.S., lxxv, 1934, pp. 110–111, 1932.

American elms [*Ulmus americana*] in eastern Massachusetts have been affected of recent years by a canker causing hypertrophy and partial or total girdling of the branches. The lesions are slightly depressed, roughened, and cracked along the margin, the surface being covered with small pustules. In one case a canker was observed to extend through several nodes of a branch, and to be sharply delimited by a raised cork layer. Branching out from this diseased area was a young twig that had been killed back, the new growth being stunted and the leaves turning brown and dry before reaching maturity.

The pycnidia of the species of *Diaporthe* (*Phomopsis*) [see preceding abstract] associated with this disease are solitary, black, smooth, carbonaceous, ostiolate with short necks, conical or elliptical. The $\alpha$ pycnospores are borne on subulate or clavate, persistent stalks measuring about 11·2 to 15·2 by 2·8 to 5·2 $\mu$, and are

hyaline, biguttulate, ovoid or elliptical with subacute or narrow pointed ends. They vary from 6·5 to 8·8 by 2·7 to 4 $\mu$. The $\beta$ spores, on similar stalks, are cylindrical, hyaline, unicellular, usually hamate and tapering to a point at the curved end, and measure 22·7 to 27·5 by 0·98 to 1·3 $\mu$. Perithecia were obtained in cultures on sterilized twigs and malt agar. They are single or clustered, separately erumpent, membranous, leathery, globose, 400 by 385 $\mu$, and usually situated in darkened, effuse stromatic areas, beneath which lines develop in the wood. The elongated, slender beaks project about 5 mm. above the surface of the twig. The cylindrical, clavate asci measure about 33 to 50 by 5·1 to 6·9 $\mu$. Long, slender, sinuous, continuous, simple paraphyses are usually present. The uni- or biseriate, bicellular, hyaline, quadriguttulate ascospores measure 10·9 to 12·3 by 3·8 to 4·5 $\mu$.

The fungus was compared with *D. protracta*, *D. perjuncta*, *D. discutiens*, *D. malbranchei*, and *D. eres* and found to correspond most closely with the last-named. Of the seven species of *Phomopsis* compared with the elm organism *P. oblonga* (regarded by Saccardo as the imperfect stage of *D. eres*) appears to agree the best. Dr. Buisman's *Phomopsis* from elms in Holland [ibid., ix, p. 5] appears, from a cultural examination, to agree in the main with the Massachusetts canker-forming organism.

**Elm disease: the present position.**—*Scottish Forestry Journ.*, xlvi, 2, pp. 194–196, 2 maps, 1932.

For the fifth year in succession a survey on the status of the elm disease (*Graphium* [*Ceratostomella*] *ulmi*) in England has been prepared by the Forestry Commission [*R.A.M.*, xi, p. 336] and maps are given showing the distribution and relative intensity of the disease. During 1932 there was a marked decline in the virulence of attack in nearly every area visited, while the number of apparent 'recoveries' (in some of which, however, the fungus is still present) considerably exceeds the incidence of fresh cases. The disease has not been reported farther north than York in the east or Chester in the west, and is believed not to extend westward beyond Devon and the Welsh border. Only in the eastern counties, more particularly Suffolk and Essex, has the die-back assumed a really grave form. The Asiatic elm varieties showing resistance to the disease in Holland [ibid., xi, p. 485] are mostly too small to replace the English elm, for which other kinds of trees should be substituted wherever possible in the badly infected areas, since eradication is impracticable over such a wide area.

Buisman (Christine). **Over het voorkomen van Ceratostomella ulmi (Schwarz) Buisman in de natuur.** [On the occurrence of *Ceratostomella ulmi* (Schwarz) Buisman in nature.]—*Tijdschr. over Plantenziekten*, xxxviii, 9, pp. 203–204, 1932.

The perithecia of *Ceratostomella ulmi* [*R.A.M.*, xi, p. 409] developed in a moist, warm atmosphere on fragments of elm bark from diseased trees from various parts of Holland. Isolations showed that both the + and – strains of the fungus were almost universally present on trees infected by sap beetles [*Scolytus scolytus* and *S. multistriatus*] and bearing coremia of *Graphium*

*ulmi*. The perithecial stage of the fungus doubtless occurs in nature on severely diseased elms and the ascospores are probably conveyed, like the conidia, from tree to tree by insects.

**Les maladies du Peuplier.** [Diseases of the Poplar.]—*Bull. Soc. Centr. Forest. Belgique*, xxxix, 9, pp. 502–512, 1932.

In this paper [which appears to have been taken from a report of the 'Commission d'Étude des ennemis des arbres, des bois abattus, et des bois mis en œuvre (France)'], a brief account is given of the symptoms, incidence, and control of canker [*R.A.M.*, x, pp. 417, 567] and of the branch disease caused by *Dothichiza populea* [ibid., xi, p. 338] on poplars in France. Most of the information has already been noticed in this *Review* from other sources. Canker seems to have first appeared some fifty years ago in the valleys of the Ourcq, Grand and Petit Morin, but most of the diseased poplars have been destroyed, and at present it is found within a rather limited area, including the valley of the Oise and some neighbouring valleys, not extending farther north than Amiens.

**Legislative and administrative measures. Spain.**—*Internat. Bull. of Plant. Protect.*, vi, 10, pp. 164–167, 1932.

By a Decree of 16th June, 1932, containing regulations for the control of diseases and pests of the olive tree and rules for securing the efficient manufacture of olive oils, the Spanish Government require that chiefs of agronomic sections when informed of the occurrence of any such disease or pest shall inspect the attacked zone in order to determine the nature of the outbreak. The State will supply gratuitously the necessary fungicides and equipment to control leaf spot (*Cycloconium oleaginum*) [*R.A.M.*, x, p. 130] as well as an expert staff to give practical demonstrations of the treatment, after which growers must carry on the treatment on their own account. In conformity with regulations already in force, it is prohibited to sell insecticides and fungicides unless accompanied by a certificate showing that they have been tested and approved by the competent Government Service.

**Amtliche Pflanzenschutzbestimmungen. Portugal.** [Official plant protection regulations. Portugal.]—*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, iv, 4, pp. 143–145, 1932.

Officials entrusted with the inspection of certified potatoes imported into Portugal must open 5 per cent. of the sealed consignments (completely emptying at least 1 per cent.) and inspect 5 per cent. of those arriving loose. The chief inspector must immediately be notified of any suspected cases of wart disease [*Synchytrium endobioticum*], and all consignments actually found to be so infected must be destroyed, or returned to their senders. Healthy consignments, i.e., those with under 5 per cent. decayed tubers, deep cuts, or other injuries (the lesions of *Actinomyces scabies* being reckoned only if involving one-tenth or more of the surface), will be furnished with properly authenticated certificates to this effect. Loose lots with more than 5 and less than 25 per cent. of decayed or injured tubers may be landed and placed in

special storage rooms under the authority of the Customs for sorting and destruction of the injured tubers, while those with over 25 per cent. of such defects must be totally destroyed.

**Legislative and administrative measures. Latvia.**—*Internat. Bull. of Plant Protect.*, vi, 10, p. 168, 1932.

Regulations published by the Latvian Administration of Agriculture on 25th April, 1932, require that any fungicide or insecticide intended for commercial sale must be submitted to official biological tests at the expense of the person concerned. The Faculty of Agriculture of the University of Latvia and the Plant Protection Institute are responsible for carrying out the tests, and a special committee will decide, on the basis of the results of these trials, whether or not the preparation tested may be placed on the market. On applying for a test the persons concerned must state in writing the composition of the product and must guarantee that this composition shall be maintained.

**Legislative and administrative measures. Morocco (French Zone).**—*Internat. Bull. of Plant Protect.*, vi, 10, pp. 168–169, 1932.

A Decree of the Director General of Agriculture, Commerce, and Land Settlement of the French Zone of Morocco dated 12th August, 1932, requires that any person selling sulphur for plant protection purposes must show on the delivery note, invoice, wrapper, container, or packing material and on the advertisements, posters, or price lists the degree of fineness of the sulphur calculated in French silk mesh. Sublimed sulphur or flowers of sulphur must contain at least 98·5 per cent. of pure sulphur, and not more than 0·5 per cent. of ash and the same of moisture. The proportion of crystals present must not exceed 12 per cent. Triturated or ground sulphur must contain at least 97 per cent. of crystalline sulphur, not more than 2 per cent. of ash and not more than 0·5 per cent. moisture. The pure sulphur content of precipitated sulphur must correspond to that guaranteed by the seller within a maximum variation of 2 per cent. The free sulphur content of other sulphur products such as native sulphur, black sulphur, cupric sulphur, &c., must be shown in accordance with the regulation above. Colloidal sulphur must be stable and without deposit and must be clear when diluted with distilled water. Its density at 20° C. and the degree of dilution at which it is to be used must be shown.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
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**Proceedings of the Seventh Spike Conference held at the Indian Institute of Science, Bangalore, on Monday, the 25th April, 1932, at 10 a.m.**—*Indian Forester*, lviii, 9, pp. 489–495, 1932.

A summary of the definite results obtained during the last five years in connexion with the study of spike disease of sandal [*Santalum album*: *R.A.M.*, xi, p. 336] was given by the chairman of the Conference, Dr. H. E. Watson, of the Indian Institute of Science, Bangalore.

The best results in the transmission of the disease have been obtained by the insertion of diseased leaf tissues [ibid., x, p. 69], while attempts to graft on the roots have so far been unsuccessful. Evidently, therefore, infection is conveyed by means of aerial agencies and not through the root system.

A method of leaf measurement facilitating the early recognition of the disease has been devised.

Certain varieties or strains of sandal possess an inherent resistance to spike, but no definite mode of identifying them has yet been evolved. Profuse root development and a strong tendency to haustorial formation appear to be typical of such varieties. *Lantana* [*camara*] has been suggested as a cause of spike. This does not seem to be actually the case, but it is an unfavourable host and likely to induce conditions adverse to healthy growth.

Lopping or ringing the affected part of a tree is sometimes useful in checking further extension, but this method of control is uncertain owing to the occasional occurrence of the disease in a latent form. In the destruction of infected trees a patent preparation known as Atlas, containing sodium arsenite, has given the best results.

A type of chlorosis has been induced in healthy sandal trees by means of certain Curculionidae fed on spiked material, but further experiments are necessary to establish a connexion between the two disorders.

McCulloch (Lucia) & Demaree (J. B.). **A bacterial disease of the Tung-Oil tree.**—*Journ. Agric. Res.*, xlv, 6, pp. 339–346, 3 figs., 1932.

This is a brief account, based chiefly on greenhouse experiments in Washington, D.C., of the bacterial disease of tung-oil trees (*Aleurites fordii*) recently described from southern Georgia by

Boyd [*R.A.M.*, x, p. 140]. Isolations from infected leaves yielded a bacterium which, in some of its characteristics, is very similar to certain known pathogens of beans (*Phaseolus* spp.), and the pathogenicity of which to tung-oil trees was proved by successful inoculations of the leaves both in the greenhouse and in the field. No infections, however, were secured on the petioles or stems. The organism is a short (1·1 to 3 by 0·6 to 0·7 $\mu$), motile, capsulate, non-sporiferous, aerobic, gram-negative, non-acid-fast rod, with 1 to 5 polar (rarely bipolar) flagella. On beef agar it forms circular to slightly lobed, white, translucent colonies, becoming greenish-white and transparent. It clouds beef bouillon and forms a pellicle, does not liquefy gelatine, does not clear or liquefy blood serum, and produces a green fluorescence in all beef media; it has a moderate diastatic action, produces readily acid without gas from dextrose, galactose, glycerine, and mannite, and slowly from saccharose, lactose, and maltose; it reduces nitrates, produces indol, ammonia, and hydrogen sulphide in small amounts, and slightly reduces litmus in milk. It grows best at $P_H$ 6·2 to 6·8, remains fully viable in herbarium specimens and in the leaves in the orchard for at least four months, and its optimum temperature for growth is 27° to 28°, with a maximum at 37° C. The organism is considered to be undescribed and is named *Bacterium aleuritidis* n.sp.

Inoculation experiments showed that *Bact. aleuritidis* is also slightly pathogenic to the castor bean (*Ricinus communis*), and causes severe infections on several varieties of French beans (*Phaseolus vulgaris*). On the leaves of the tung-oil tree, the bacteria enter through the stomata, and infection was most active when the plants were kept in a moist atmosphere for 24 to 48 hours. It is believed that the bacteria probably overwinter in the lesions on fallen leaves.

Ritchie (J. H.). **Some observations on thê honey agaric (Armillaria mellea syn. Agaricus melleus).**—*Scottish Forestry Journ.*, xlvi, 2, pp. 132–142, 2 figs., 1932.

A study has been made of the distribution and pathogenicity of the honey fungus (*Armillaria mellea*) [*R.A.M.*, xi, p. 681] in three areas in the north-east of Scotland, viz., Pitfour and Fyvie (Aberdeenshire) and Durris (Kincardineshire).

At Pitfour the disease has broken out in a plantation consisting mainly of Norway spruce (*Picea excelsa*) and Scots pine (*Pinus sylvestris*), of which the latter was much the more susceptible, 22 per cent. of the stand being destroyed; only one case was observed on the spruce and here infection was secondary to injuries inflicted by deer. Most of the mortality occurred in a part of the plantation where the ground vegetation is composed largely of *Deschampsia caespitosa* with occasional clumps of male fern (*Lastraea filix-mas*), and there is a stony layer near the surface just below the raw humus. In some cases the rhizomorphs are able to penetrate the stem bark under cover of the leaf litter, and in one instance of a Scots pine killed by the fungus they were found boring right through to the phloem. The rhizomorphs, moreover, always extruded their tips to any forking into two roots where the

bark was usually wrinkled. Below the Norway spruce trees the soil is kept drier by the dense foliage than under the pine, and the rhizomorphs are correspondingly less vigorous. Stumps saturated throughout with water always show a much greater number of rhizomorphs than dry ones. The only feasible method of control is trenching round the infected area.

At Durris the fungus has infected a plantation of twenty-five-year-old silver firs (*Abies nobilis*), the mode of attack being similar to that already described. The soil in this plantation is a fine loam with an upper layer of raw humus and there is a considerable amount of moisture.

At Fyvie the disease is reported to have been present for at least thirty years on an eighty-year-old pure plantation of Scots pine. The affected site is at the top of a hill, so that bad drainage cannot be a factor here, but the ground is very stony. For at least fifteen years some trees have been killed annually by the disease and cut out, leaving a bare area $1\frac{1}{2}$ to 2 acres in extent, the total number of deaths in this area being roughly estimated at 80 to 90 per cent. An attempt was made a few years ago to keep the fungus within bounds by means of a surrounding trench, but this was only partially successful owing to subsequent filling up which enabled the rhizomorphs to cross it. Infection now appears, however, to be dying out naturally in this area, since no trees were killed in 1931 and very few rhizomorphs could be found in the soil.

In the Scots pine the rhizomorphs enter through cracks in the successive cortical layers until the soft inner bark is reached. In the spruce and silver fir the bark does not crack, but that of the latter is much softer and less compact than in the spruce and also tends to run into folds at the collar which are easily penetrated.

Dodge (B. O.). **Notes on three Hemlock fungi.**—*Mycologia*, xxiv, 5, pp. 421–430, 2 pl., 1 fig., 1932.

The examination at the end of 1931 of the branches of a few small hemlock trees (*Tsuga canadensis*), showing signs of a fungal blight, at Scarsdale, N.Y., revealed three species of fungi, the most conspicuous among which was identified as *Cenangium balsameum* Peck, which is stated to have been transferred by Seaver (in an unpublished monograph of *Dermatea*) to the latter genus under the name *D. balsamea* n. comb. On corn meal agar the fungus (grown from single ascospores) produced micropycnidia, the spores in which somewhat resembled the stylospores of a *Phomopsis*. Later well-organized pycnidia were formed, it is believed probably directly from the micropycnidia, and contained septate, slender, flexuose, slightly twisted or sigmoid macroconidia. This conidial stage, which was also present on the hemlock branches in nature, agrees well with Peck's description of *Gelatinosporium abietinum*, and is essentially a *Micropera* as indicated by von Höhnel.

The second fungus was a species of *Myxosporium*, the identity of which was not established, as its ascogenous stage was not found. It does not appear to be related to *G. abietinum*, but is probably connected with some other species of *Dermatea*, possibly *D. livida* [*R.A.M.*, x, p. 633].

The third species, found on the branches as a secondary parasite,

was identified as *Phomopsis occulta*, the conidial stage of *Diaporthe conorum* [ibid., x, p. 278].

Investigations are in progress to determine the pathogenicity of the three species to hemlock.

GREGOR (MARY J. F.). **The possible utilisation of disease as a factor in Bracken control.**—*Scottish Forestry Journ.*, xlvi, 1, pp. 52–59, 3 figs., 1932.

Bracken [*Pteridium aquilinum*] in the west of Scotland is liable to a severe die-back disease associated with an undetermined species of *Mycosphaerella* [*R.A.M.*, xi, p. 215], which may possibly prove to be of value in the eradication of the fern under average environmental conditions. A second disease, occurring in the west of Scotland and north-eastern Ireland exclusively in very damp situations, is also highly destructive within its more limited scope, killing the fronds and spreading for a short distance down the leaf stalks. The dead leaf segments shrivel and fall off, so that in severe cases little is left but the bare axis of the frond covered with the felt-like mycelium of the fungus. Spherical or oval sclerotia, up to a quarter of an inch in diameter, with a dark brown outer wall, are formed on the dead areas and probably serve to carry the organism (a species of *Corticium*) [see next abstract] through the winter.

GREGOR (MARY J. F.). **Observations on the structure and identity of Tulasnella anceps Bres. et Syd.**—*Ann. Mycol.*, xxx, 5–6, pp. 463–465, 1932. [German summary.]

In connexion with a study of the bracken (*Pteridium aquilinum*) disease caused by a sclerotial fungus in Scotland [see preceding abstract], the writer has examined material of *Tulasnella anceps* Bres. & Syd. (*Ann. Mycol.*, viii, p. 489, 1910) in comparison with *Corticium vagum* and *C. solani*, to the former of which it had been referred by Bourdot and Galzin. While its transfer to the genus *Corticium* is accepted, the author considers it to be distinct from the two species mentioned, which are apparently identical or very closely related to one another. The bracken fungus in Scotland is referred to *C. anceps* (Bres. & Syd.) Gregor n. comb. The sclerotia found on bracken in nature have also been formed in cultures of *C. anceps* on 5 per cent. malt extract agar and do not appear to have been observed by the previous investigators. They are highly resistant, being able to withstand ten minutes' immersion in 1 in 1,000 mercuric chloride. The white mycelium of *C. anceps* exhibits zonation in culture, and has not formed basidia or spores on any of the media tested.

GÄUMANN (E.). **Der Einfluss der Fällungszeit auf die Dauerhaftigkeit des Fichten- und Tannenholzes.** [The influence of the time of felling on the durability of Fir and Spruce wood.] —*Angew. Bot.*, xiv, 5, pp. 387–411, 3 figs., 10 graphs, 1932.

This is a condensed account of the author's laboratory and field studies in Switzerland on the influence of the date of felling on the durability of fir and spruce wood, as gauged chiefly by its resistance to parasitic fungi [*R.A.M.*, x, p. 146].

**Analytische Methoden zur Bestimmung von Quecksilber, Zink, Fluor, und Arsen in imprägnierten Hölzern.** [Analytical methods for the determination of mercury, zinc, fluorine, and arsenic in impregnated woods.]—*Chem. Zeit.*, lvi, 74, pp. 730–731, 1932.

Full details are given of the analytical methods in use at the Rütgers Wood Preservative Laboratory, Berlin, for the estimation of mercuric chloride, zinc chloride, the water-soluble fluorides, and arsenical compounds in impregnated timber [cf. *R.A.M.*, xi, p. 15].

The method of mercury analysis consists in the boiling of the wood in hydrochloric acid with the addition of sodium chlorate, reduction of the lixiviated sublimate with stannous chloride, followed by the titrimetric determination of the filtered-off mercury dissolved in nitric acid.

The estimation of zinc chloride necessitates the fragmentation of the wood, which is then charred in a porcelain crucible; hydrochloric acid is poured over the residue, the resultant solution boiled, made alkaline with dilute ammonia, and filtered off. The filtrate is reacidified with hydrochloric acid and the zinc determined by one of the usual methods.

The estimation of the fluorides is based on the following principle. The fluorine salt is converted into insoluble, thermostable calcium fluoride by the saturation of the wood in a lime salt solution. The wood is then reduced to ashes, which are freed from calcium carbonate by treatment with dilute acetic acid, and dissolved by Penfield's method in sulphuric and silicic acid; the resultant $SiF_4$ is then titrated with sodium lye.

Arsenic in the form of arsenic trichloride is distilled from the treated wood after the addition of fuming hydrochloric acid, and the arsenic in the distillate titrated.

WELLMAN (F. L.). **Rhizoctonia bottom rot and head rot of Cabbage.**—*Journ. Agric. Res.*, xlv, 8, pp. 461–469, 3 figs., 1932.

As a result of his investigations in the cabbage-growing districts of the United States from 1923 to 1928, inclusive, of the incidence and prevalence of head rot and bottom rot of cabbage caused by *Corticium vagum* [*C. solani*: *R.A.M.*, vi, p. 590; x, p. 421], the author states that the bottom rot occurs every year, while the head rot develops only at times in the field, under conditions that have not yet been exactly defined. Isolations and inoculation experiments have shown that both diseases [a brief description of which is given] of the older plants are caused by the same strain of the fungus that produces damping-off or wire stem [loc. cit.] of cabbage seedlings. Cross-inoculation experiments with strains of *C. solani* isolated from cabbage, beans, beet, peas, potato, and lettuce showed that the strains from the other hosts did not cause head or bottom rot of cabbage, though the lettuce strain caused cabbage seedlings to damp-off. All the strains appeared to be most active on the hosts from which they were originally isolated.

Experiments under controlled conditions showed that a relatively large amount of moisture is necessary for the optimum development of both head rot and bottom rot; both developed

at temperatures ranging from 9° to about 32° C., with an optimum between 25° and 27°.

COTTIER (W.). **Insect transmission of dry-rot (Phoma lingam) of Swedes.**—*New Zealand Journ. of Agric.*, xlv, 4, pp. 219–224, 2 figs., 1932.

The results of continued experiments [details of which are given] on the transmission by insects of dry rot (*Phoma lingam*) of swedes [*R.A.M.*, x, p. 151] definitely showed that, as indicated in the earlier work, the disease is distributed by insect vectors, among which the Staphylinid beetle *Atheta pseudocoriaria* and the Drosophilid fly *Drosophila rubrostriata* appear to be the most active and efficient carriers. In the experiments more disease was transmitted by *D. rubrostriata* than by *A. pseudocoriaria*, presumably owing to the fact that the former usually flies from one host to the next, while the beetle keeps by preference to its legs. There also was evidence that surface injured swede roots were more readily infected than perfectly sound ones.

CHENEY (GWENDOLYN M.). **Pythium root rot of Broad Beans in Victoria.**—*Australian Journ. Exper. Biol. & Med. Sci.*, x, 3, pp. 143–155, 6 figs., 1932.

Broad beans (*Vicia faba*) in the Melbourne district have been severely affected of recent years by a disease involving decay of the roots and stunting or collapse of the plants. In advanced cases nothing remains of the root system but a shrivelled vascular cylinder. As a rule no symptoms are observed on the stems and leaves until the plant is at least 8 in. high, and usually not before the formation of flower buds at a height of 2 to 3 ft.; then the tips of the shoots become flaccid and bend over, while the leaves curl in from their edges. The lower leaves wilt and turn black, and at the same time dark streaks appear on the stem base, which subsequently turns black and assumes a waterlogged aspect. The flowers may die and fall off, or they may form pods, but the latter remain stunted and generally wither. In sandy soils the symptoms appear much earlier, when the plants are a few inches high. The leaves are upcurled, small, narrow, and crowded, and the plants remain stunted, fail to set seed, and are eventually killed.

A *Pythium* was readily isolated from diseased material and grown on various media. In culture it is characterized by irregularly septate, granular, hyaline hyphae, 4 to 10 $\mu$ in diameter (average 7·5 $\mu$), rounded at the ends; sparse terminal or intercalary, spherical to subspherical conidia, 13 to 26 $\mu$ (average 21·5 $\mu$) in diameter, germinating directly by one or more germ-tubes; smooth, spherical or occasionally irregular, terminal or intercalary oogonia, 13 to 23 $\mu$ (average 19·7 $\mu$) in diameter; single or double antheridia arising from the oogonial stalk at some distance from the oogonium, or from a branch, arched, narrow (only slightly exceeding the diameter of the stalk); spherical, smooth-walled oospores, usually not filling the oogonium, 11·5 to 17·5 $\mu$ (average 15·7 $\mu$) in diameter, not observed to germinate. The species differs from *P. ultimum* [*R.A.M.*, xi, pp. 344, 408], to which it is most

closely related, in its antheridial and conidial characters. It is named *P. fabae* n. sp., with an English diagnosis.

The mycelium was found in abundance in the cortex (where the hyphae are mainly intercellular) and in the vascular cylinder, causing disintegration. Oospores were also found in the cortex and in the roots. Inoculation experiments on pot plants resulted in rotting of the roots after three weeks, followed three weeks later by the development of external symptoms.

V. A. Wager is stated to have isolated a species of *Pythium* in South Africa apparently identical with that on the broad bean, but there seem to be no other records of a disease of this host caused by *Pythium*. The inoculation tests of Sideris have shown, however, that *V. faba* is susceptible to most species of the genus [ibid., x, p. 555].

P. (L.). **Considérations sur les maladies de la Betterave ainsi que sur les maladies parasitaires des plantes en général.** [Reflections on Beet diseases and on the parasitic diseases of plants in general.]—*Bull. Assoc. Chim. Sucr., Dist. & Indus. Agric. de France*, xlix, 5, pp. 197–199; 6, pp. 232–235, 1932.

In connexion with a mainly theoretical dissertation on the nature of disease in the beet and other plants, the writer mentions the beneficial effects of lime and magnesia on the course of dry rot [*R.A.M.*, xii, p. 2]. These observations were exemplified by an experiment in which young beets affected by the disease in a clay soil poor in both the above-mentioned elements recovered completely on transference to a soil containing both in abundance.

Miestinger (K.), Fischer (R.), Watzl (O.), & Porsch (L.).—**Wichtige Schädlinge und Krankheiten der Rübe in Österreich.** [Important pests and diseases of the Beet in Austria.]—*Bauernschr.* 37 (Niederösterr. Landes-Landwirtschaftskammer), 28 pp., 15 figs., 1932.

Popular notes are given on the symptoms and control of the following diseases affecting beets in Austria; root rot [*Pythium de Baryanum, Phoma betae*, and to a lesser extent *Aphanomyces levis* and *Pythium aphanidermatum*: *R.A.M.*, x, p. 768], heart and dry rot [see preceding abstract], leaf spots (*Cercospora beticola* and *Ramularia betae*) [ibid., ix, p. 757], mildew (*Peronospora schachtii*), rust (*Uromyces betae*), red rot (*Rhizoctonia violacea*) [*Helicobasidium purpureum*] [ibid., x, p. 701], a bacterial rot of the 'tail' or tap root, and various types of scab of combined bacterial and fungal origin.

Du Plessis (S. J.). **Parasitisme, morphologie en physiologie van Fusarium solani (Mart.) Sacc. op Uie.** [Parasitism, morphology, and physiology of *Fusarium solani* (Mart.) Sacc. on Onion.]—*Ann. Univ. Stellenbosch.*, Ser. A, x, 2, 17 pp., 3 figs., 1 graph, 1932. [English summary.]

*Fusarium solani* [*R.A.M.*, xi, pp. 67, 226] was isolated from onion bulbs at Stellenbosch, Cape Province, simultaneously infected by *F. cepae* and *Sclerotium cepivorum* [ibid., x, p. 429; xi, p. 219]. Inoculation experiments with the first-named fungus through the

seed, soil, and growing bulbs gave negative results, but when harvested bulbs of the Early Cape variety were inoculated and kept for 48 hours in a saturated atmosphère, they developed a dry rot ending in complete mummification in a month. *F. solani*, therefore, may be regarded as a weak parasite capable of infecting onion bulbs from which the toxic substance in the scales repelling fungous pathogens [ibid., iv, p. 519] disappears on the cessation of growth. A high degree of humidity is a necessary condition for infection. The same fungus caused a watery rot of healthy potato tubers under favourable conditions in the laboratory.

Details are given of the morphology of *F. solani*, including a table of the conidial dimensions on various standard media. The average sizes are as follows: 1-cellular, 3·3 to 18·3 by 1·3 to 5·3 $\mu$ (average 8·4 by 3·3 $\mu$); 2-cellular, 6·7 to 28·3 by 2 to 6·7 $\mu$ (15·8 by 3·7 $\mu$); 3-cellular, 11·7 to 36·7 by 3 to 6·7 $\mu$ (22·1 by 3·8 $\mu$); 4-cellular, 18 to 40 by 3 to 6·7 $\mu$ (30·7 by 3·8 $\mu$); 5-cellular, 28·3 to 41·7 by 3·3 to 5·7 $\mu$ (34·5 by 4·3 $\mu$); and 6-cellular, 23·3 to 45 by 3·3 to 6·7 $\mu$ (33·2 by 3·7 $\mu$). The best growth was made at an alkaline reaction (− 10° Fuller's scale), though development occurred also at − 30° and + 10°, and the optimum temperature was found to lie between 27·5° and 28·5° C.

This is believed to be the first record of *F. solani* as an agent of storage rot of onions.

WELLMAN (F. L.). **Celery mosaic control in Florida by eradication of the wild host Commelina nudiflora.**—*Science*, N.S., lxxvi, 1974, pp. 390–391, 1932.

Recent investigations on the control of celery mosaic in the Sanford district of Florida have shown that the disease may be greatly reduced by the eradication of the only important wild host, *Commelina nudiflora* [*R.A.M.*, x, p. 429]. The only insect found to carry the disease is *Aphis gossypii*, but infection is readily conveyed from plant to plant by mechanical means. The virus persists from season to season in the growing plants of *C. nudiflora.*

KUNKEL (L. O.). **Celery yellows of California not identical with the Aster yellows of New York.**—*Contrib. Boyce Thompson Inst.*, iv, 3, pp. 405–414, 2 figs., 1932.

Yellowed specimens of aster, celery, and carrot were sent to the writer by Severin from California [*R.A.M.*, x, p. 286] and used in comparative transmission tests with the New York aster yellows [ibid., x, p. 734].

The Californian yellows was readily transmitted from aster to Silver and Golden Self Blanching and White Plume celery plants by colonies of *Cicadula sexnotata*, whereas the New York aster yellows was not similarly transmissible to celery. The Californian disease was transferred from an experimentally infected Silver Self Blanching celery plant to asters of the Semple's Late Flowering variety. Transmission of Californian yellows was further effected from carrot to aster. On asters the symptoms of the two diseases were quite similar. In two tests of the length of time required for the incubation of the Californian yellows virus in the vector, periods of 17 and 18 days, respectively, were shown, while

in six other experiments 19 to 26 days elapsed between infection and the development of the symptoms. These results agree in the main with those obtained in similar tests with the aster yellows of New York. In respect of transmission to celery, however, the Californian yellows differs from the New York aster yellows.

SPRAGUE (R.). **Notes on Phyllosticta rabiei on Chick Pea, II.**—*Phytopath.*, xxii, 9, pp. 786–787, 1932.

The author does not approve of Labrousse's proposal to transfer the causal organism of chick pea anthracnose from *Phyllosticta* to *Ascochyta* as *A. rabiei* (Pass.) nov. comb. [*R.A.M.*, xii, p. 75] on account of its sometimes septate conidia and occurrence on organs other than leaves. Though technically justifiable, a rigid adherence to these as generic characters would cause much confusion in several analogous cases, which are briefly discussed. The writer cannot follow Labrousse in considering *A. pinodella* L. K. Jones as a parallel case to *P. rabiei*, since collections of the former show septation in nearly 100 per cent. of the spores, whereas in the latter 96 to 98 per cent. are non-septate. The retention of the combination *P. rabiei* (Pass.) Trotter is, therefore, advocated.

GHESQUIÈRE (J.). **Sur la 'mycosphaerellose' des feuilles du Manioc.** [On 'mycosphaerellosis' of Cassava leaves.]—*Bull. Inst. Roy. Colon. Belge*, iii, 1, pp. 160–178, 1932.

The author states that *Mycosphaerella manihotis* Ghesq. et Henr. described by him and Henrard on cassava in the Belgian Congo in 1924 [*R.A.M.*, v, p. 530] appears to be a synonym of *M. manihotis* Syd. described in 1901 on cassava in the Argentine; the slight differences in the description being attributable to the state of maturity of the fungus, or to ecological reactions. *Lizonia manihotis* Zimm. is also considered to be the same organism. The imperfect stage of *M. manihotis* is a *Cercospora*, referred to *C. cassavae*, which develops on the same dark brown mycelial stroma as that in which the perithecia form. A list is given of the species of *Cercospora* hitherto found on the same host, *Cercosporella* forms being included [cf. ibid., v, p. 144; xi, p. 130]. The paper terminates with a brief review of the geographical distribution of the disease caused by *Cercospora cassavae*, a note on control methods, and a three-page bibliography. In a footnote on p. 172 it is stated that the insect vector of the common mosaic disease of cassava [ibid., xi, p. 761] has been found by the writer and Kufferath to be an Aleurodid, *Bemisia mosaicivecta* n. sp., to be described shortly in the *Rev. Zool. Bot. Afr.* of Brussels.

WAKSMAN (S. A.) & NISSEN (W.). **On the nutrition of the cultivated Mushroom, Agaricus campestris, and the chemical changes brought about by this organism in the manure compost.**—*Amer. Journ. of Botany*, xix, 6, pp. 514–537, 5 graphs, 1932.

Further studies have been carried out in New Jersey on the chemical composition of horse manure composts prepared for the growth of the cultivated mushroom (*Agaricus* [*Psalliota*] *campestris*) [*R.A.M.*, xi, p. 3].

In comparative tests of mushroom growth on two types of manure, with and without bedding, and with and without additional straw, the best results were obtained from manure with bedding and 25 per cent. wheat straw, as well as the requisite amounts of nitrogen and mineral nutrients.

The process of manure composting is accompanied by a rapid development of fungi and bacteria, which cause a reduction in the water-soluble substances of the manure, in the hemicelluloses, and to a slighter extent in the cellulose, with a corresponding relative increase in the lignin and total nitrogen contents and the ash.

*P. campestris* does not use the compost as a whole for its very considerable nutritional and energy requirements, but attacks by preference the lignins and the organic nitrogenous complexes, and to a lesser extent the hemicelluloses and the cellulose. In the course of its growth the lignins are markedly reduced, both in absolute quantity and relatively to the other organic complexes, the nitrogenous substances being at the same time transformed from an insoluble organic into soluble organic and mineralized ($NH_3$) forms. The high content of water-soluble nitrogen is due to the fact that nitrogen constitutes 6·44 per cent. of the dry weight of the mycelium, with nearly half the quantity in a water-soluble form.

The bulk of the compost left after the growth of the mushroom consists of the mycelium and products of decomposition of the fungus.

Servière (H.). **Réflexions sur le mildiou.** [Reflections on mildew.]—*Prog. Agric. et Vitic.*, xcviii, 37, pp. 258–260, 1932.

The severity of the vine mildew (*Plasmopara viticola*) outbreak in France in 1932 [*R.A.M.*, xii, p. 72], which at the beginning of September showed signs of causing at least as heavy financial losses as in 1930 [ibid., x, p. 580], leads the author to point out that the first, early spring invasion of the fungus may be to a great extent checked, if not completely suppressed, by the destruction of the oospores which overwinter in or on the soil in the vineyards. To be effective as a source of infection, the oospores must be washed into close proximity to the vine stocks, since their zoospores cannot be carried by wind to long distances without losing viability. This indicates the advisability of removing all adventitious growth that develops at the base of the stocks in the spring, since this is highly susceptible to the fungus; it could be destroyed by spraying with a copper sulphate solution of a concentration sufficient to kill it, while still being uninjurious to the wood.

Cornu (C.). **Bouillies de cuivre mouillantes et adhérentes.** [Wetting and adhesive copper spray mixtures.]—*Prog. Agric. et Vitic.*, xcviii, 38, pp. 279–284, 1932.

After stating that the protective efficacy against vine mildew [*Plasmopara viticola*] of an otherwise chemically good cupric spray depends chiefly on its wetting and adhesive properties, the author suggests a rule-of-thumb method for the rapid evaluation of these properties, for the guidance of vine-growers in the choice

of ready-made commercial products. The evaluation of the wetting property is based on the fact that a liquid is more wetting as its surface tension decreases, and that liquids with a low surface tension, when issuing from a dropper (stalagmometer) of a given calibre, give more drops for the same volume than liquids with a high surface tension [cf. *R.A.M.*, xi, p. 153].

The adhesiveness of the spray mixtures may be roughly estimated by depositing drops from a standard volume of the liquid tested on a standard piece of waterproof paper which, after spontaneous drying, is fixed to a wood strip and then washed by repeated dipping in water (preferably rain water, the content of which in carbon dioxide may be artificially increased). The piece of paper is then incinerated and the content of the ash residue in copper is evaluated by the usual method; the more adhesive liquids will obviously give a higher copper residue after washing than the less adhesive.

Touze (A.). **Résultats d'essais de traitement à l'alun.** [Results of control experiments with alum.]—*Prog. Agric. et Vitic.*, xcviii, 42, pp. 368–369, 1932.

Following a communication of an observation that alum sprays appeared to have a curative effect on vine mildew [*Plasmopara viticola*], the author made in August, 1932, a small range of experiments, in which he used a 4 per cent. solution of alum to spray grape bunches showing various degrees of intensity of attack by the fungus. The results [shown in a table] failed to reveal any controlling effect of the alum spray on the development of the mildew.

**Reports on the work of Agricultural Research Institutes and on certain other agricultural investigations in the United Kingdom. 1930–1931.**—377 pp., London, H.M. Stationery Office, 1932.

The following are among the items of phytopathological interest, not already noticed from other sources, in this report, which is prepared on the same lines as that of the preceding year [*R.A.M.*, x, p. 583].

Investigations (under the auspices of the Scottish Society for Research in Plant Breeding) at the North of Scotland sub-station, Gibston, Huntly, Aberdeenshire, are in progress on potato mosaic. In a series of grafts and inoculations between potato varieties and seven species of Solanaceae, *Hyoscyamus niger* was found to be of value in differentiating between mosaics [ibid., xi, p. 735], and also in determining the presence of the mosaic and necrotic viruses latent in apparently healthy plants [cf. ibid., xii, p. 48].

A strawberry wilt responsible for considerable losses at the Horticultural Research Station, Cambridge University, as well as in the King's Lynn district of Norfolk, appears to be due to a species of *Verticillium* [cf. ibid., xi, p. 727], experimental work on which is in progress.

In continued studies on bracken [*Pteridium aquilinum*] diseases [ibid., viii, p. 412] attempts were made at the West of Scotland Agricultural College to spread infection in the field by

transplanting blocks of bracken a yard or more square from diseased to healthy sites, but so far seven out of eight transplants have given negative results, while the outcome of the remaining test was inconclusive.

At the University College of Wales, Aberystwyth, fairly good control of onion mildew [*Peronospora schleideni*: ibid., xi, p. 689] was given by a new resin-sulphur spray with superior adhesive properties. Onion varieties showing marked resistance to white rot (*Sclerotium cepivorum*) have been developed as a result of several years' tests at Manchester University [ibid., ix, p. 356], and breeding work is in progress at the Horticultural Research Station, Cambridge, to combine this character with desirable market qualities.

The severity of apple mildew (*Podosphaera leucotricha*) [ibid., x, pp. 159, 465] was found by experiments at Manchester to be greatly minimized by a dressing of sulphate of potash at the rate of 3 cwt. per acre.

Observations and experiments at Reading University have confirmed the view that dry rot and canker of swedes [*Phoma lingam*] may be present at every stage from the sowing of the seed to the storing of the roots or the harvesting of the seed crop [ibid., xi, p. 489]. Notwithstanding the damp summer, no infected seed crop was observed where the amount of disease in the seed was likely to exceed a maximum of 1 to 2 per cent. Further evidence has been obtained of the extensive transmission of the fungus on *Brassica alba*, occurring as a weed in swede fields [ibid., x, p. 584]. Good control of *P. lingam* on swedes grown from badly infected seed was given by Du Pont granosan (the name under which the American Du Bay ceresan is sold in England) and the European ceresan dusts.

*Phytophthora cryptogea* var. *richardiae* [ibid., ix, pp. 272, 594] has been shown at Reading to be the cause of a tulip disease of which 'shanking' is only one phase, the fungus being also responsible for root rot and complete decay of the flowering shoot.

**Rothamsted Experimental Station Report for 1931.**—199 pp., 1 fig., 1 diag., 1 graph, 1932.

This report contains the following items of phytopathological interest. J. Singh found that the types of soil fungi occurring in differently manured plots were much the same, but the numbers were consistently higher on the more fertile plots. No evidence was obtained of seasonal fluctuations in numbers [*R.A.M.*, viii, p. 126].

J. Henderson Smith and his assistants found that the juices extracted from plants affected by virus diseases contain particles, the size of which has been estimated [ibid., xi, p. 735], but it is uncertain whether the virus itself is particulate or merely attached to other particles. In a case in which specific bacteria are regularly associated with the symptoms of a virus disease, the inoculation of plants grown under aseptic conditions with bacterium-free virus was found to produce the typical disease, while the organisms usually connected with it did not develop. The virus was never found to enter an unbroken cell. Large quantities of virulent

juice may be injected into the leaf of a plant through the stomata, but unless some of the cells are ruptured no symptoms will develop [ibid., xi, p. 754].

The causal organism of blackarm and angular leaf spot of cotton (*Bacterium malvacearum*) has been shown by R. H. Stoughton to dissociate into a number of culturally distinct strains with varying degrees of virulence [ibid., xi, p. 772]. Strongly virulent strains may give rise to almost non-virulent ones, which in their turn may revert to the culturally divergent virulent form. Air temperature plays the chief part in the development, as apart from the spread, of the disease [ibid., xi, p. 297]. In the control chambers, severe secondary infection of the growing plant with a virulent culture is only obtained by spraying at temperatures above 30° C. Soil temperature is less important, though it plays some part in determining the amount of disease on the very young seedlings grown from infected seed, this being less at temperatures above 30°. Air humidity is the principal factor in allowing secondary spread of the disease. Internal infection of cotton seed was found to be very rare, most cases of primary infection arising from external contamination.

W. B. Brierley found that two or more races of *Botrytis cinerea* were obtainable from a single lesion in most cases of spontaneous infection by this fungus [ibid., xi, p. 477]. No evidence was forthcoming in numerous experiments, designed to study the educability of individual races, that changes could be produced extending beyond one generation.

No correlation was found by L. M. J. Kramer in his observations at Rothamsted and Woburn between manurial treatment and severity of infection by late blight of potatoes (*Phytophthora infestans*). Pot culture experiments indicated, however, that the excessive use of phosphatic fertilizers increases tuber infection by pink rot (*P. erythroseptica*) [ibid., ix, pp. 136, 203, 225, 809].

Notes are given by Miss M. D. Glynne on the fungous diseases of crops on the Rothamsted and Woburn experimental plots during the period under review.

SAMUEL (G.). **Summary of plant disease records in South Australia for the two years ending June 30th, 1932.**—*Journ. Dept. Agric. S. Australia*, xxxvi, 3, 300-301, 1932.

This summary of plant disease records made in South Australia during the two years ending June 30, 1932, contains the following items of special interest.

In 1931 the red grass-destroying fungus *Isaria graminiperda* was reported for the first time from various localities in northern and south-eastern parts of the State, principally as causing small patches of infection on *Poa bulbosa*.

Diseases of citrus included brown rot (*Phytophthora hibernalis*) [*R.A.M.*, xi, p. 222], which caused heavy losses in non-irrigated areas, especially the Inman valley, and bacterial spot (*Bacterium citriputeale*), which was more prevalent than usual. Two new records on citrus were a stem-end rot caused by a *Phomopsis* closely agreeing with *P. californica* [ibid., ix, p. 766; x, p. 98], reported once from the Coromandel valley, and a black, leathery

rot with reddish margins due to a *Pleospora* closely agreeing with *P. herbarum* [ibid., xi, p. 449]. *Armillaria mellea* was found on oranges after the digging in of chips from the wood heap, and crinkle (cracking of the rind pith under the surface) was occasionally reported from the drier areas.

*Stereum purpureum* is becoming more prevalent in the Adelaide hills, where it causes silver leaf of plums, apricots, and apples; it was also present in Kangaroo Island.

Bacterial blight of French beans (*Phytomonas* [*Bact.*] *medicaginis* var. *phaseolicola*) [ibid., xi, pp. 418, 687, 759] caused considerable losses in 1931 and 1932. *A. mellea* severely damaged a bed of parsnips and carrots at Kingston. Neck rot (*Botrytis allii*) and smudge (*Colletotrichum circinans*) of onions were recorded for the first time, as was a *Fusarium* wilt of watermelons.

The tomato spotted wilt virus [ibid., xi, p. 609; xii, p. 59], usually found only on sparsely scattered tobacco plants, in 1932 destroyed over 30 per cent. of a small tobacco field at Mount Gambier.

In 1931 *Phytophthora infestans* was recorded for the first time on seedling petunias in frames.

Pole Evans (I. B.). **Arable farming and pasture problems.**—*Farming in South Africa*, vii, 80, pp. 341–352, 2 figs., 1932.

The following items of phytopathological interest, other than those already noticed from other sources, occur in this report. A few coffee trees of the Mocha variety in experimental plots have, for the first time, shown signs of leaf disease (*Hemileia vastatrix*), which Mysore and Robusta have hitherto escaped [cf. *R.A.M.*, xi, p. 572, and below, p. 169].

Previous experiments had shown an increase in the severity of bitter pit, one of the heaviest sources of loss in the South African apple industry, with a rise in temperature from 32° to 40° F., but subsequent tests indicated that a minimum of this trouble occurs round about 70° [ibid., xii, p. 103].

Out of 818,705 citrus trees inspected for scaly bark or psorosis [ibid., x, p. 97] in the Eastern Transvaal only 88 were found to be infected, while in the Rustenburg district there were only 5 diseased among 2,381.

*Armillaria mellea* has been found to cause a serious disease of trees in the Government forest reserves of the Louis Trichardt area, those affected including *Pinus longifolia*, *Cedrela toona* [ibid., viii, p. 202], *C. odorata*, *Grevillea robusta* [ibid., x, p. 275], and *Juniperus procera*. In the forest, fructifications of the fungus were found on decaying stumps of *Parinarium mobola*, which probably acted as a source of infection [ibid., viii, p. 202]. Subsequently the disease was observed on living trees of *Eucalyptus paniculata* in a plantation cleared of *C. toona*.

The Marvel and Stone tomato varieties have shown a high degree of resistance to wilt [*Fusarium lycopersici*].

Beans [*Phaseolus vulgaris*] have suffered considerably from bacterial blight [*Bacterium phaseoli*] and mosaic.

The leaf spot of dahlias due to *Entyloma dahliae* [see below, p. 177], hitherto confined to Natal, has been reported from the Transvaal.

STOREY (H. H.). **Report of the Plant Pathologist.**—*Fourth Ann. Rept. East African Agric. Res. Stat., Amani, 1931–2*, pp. 8–13, 1932.

In addition to items already noticed from other sources, this report contains the following information. A maize disease has been observed in the Amani district closely resembling streak [*R.A.M.*, xi, p. 592] but transmissible by the Fulgorid leafhopper, *Peregrinus maidis*, which cannot transmit streak, while conversely *Cicadulina mbila*, the vector of maize streak, is unable to convey the new virus. Possibly the latter may be identical with that investigated by Stahl in Cuba [causing stripe disease: ibid., vii, p. 160].

Negative results were given by experiments, in co-operation with the Station entomologist (T. W. Kirkpatrick), to transmit leaf curl of tobacco to cotton by the whitefly *Bemisia* sp. [ibid., xii, p. 58]. This tobacco disease appears to be widespread in Africa, the Amani investigations having been commenced as a result of the loss of an entire crop in Zanzibar. The same disease is also reported to occur in the Transvaal. The writer has further been informed in correspondence by J. Ghesquière that a similar tobacco disease in the Belgian Congo is transmissible by whiteflies.

During July and August, 1931, the writer confirmed the identity of the groundnut rosette occurring in Uganda with that previously investigated in South Africa [ibid., vii, p. 486]. Apparently the disease may be largely controlled by the existing native methods of cultivation, important features of which are a heavy broadcast sowing-rate and grass-mulching of the soil after sowing. Negative results were given by experiments at Amani in the transmission of the rosette virus to a number of other Leguminosae.

**Administration Report of the Director of Agriculture, Trinidad and Tobago for the year 1931.**—61 pp., 1932. [Received December, 1932.]

In 1931 bronze leaf wilt of coco-nuts [*R.A.M.*, xii, p. 90] was present on approximately 400 out of over 1,900 properties in Trinidad. Severe losses were sustained, mostly on heavy soils, but the disease was sometimes absent from these and present on free-draining, light land; it was not observed, however, in the more important areas, where the coastal belts in which the palms are grown consist chiefly of free-draining, sandy soil.

Attempts to produce a lime resistant to wither-tip [*Gloeosporium limetticolum*: ibid., xii, p. 22] were mainly confined to field trials of two 1932 hybrids, of which T1 shows promise.

To control witches' broom of cacao (*Marasmius perniciosus*) [ibid., xi, p. 483] all diseased tissues found on the experimental Marper estate were cut out and burnt every month, the total found being 251,079, or 2,684 per acre, and the total annual cost including supervision 7·23 dollars [= approximately £1 10*s*. at par] per acre. The heaviest incidence was in February, when 97,492 diseased parts were destroyed. Evidence was obtained that a few brooms dried up about 14 days after developing, the majority in 20 to 28 days, and others within 42 days, though two required,

respectively, 55 and 65 days. Brooms sheltered from wind and rain adhered longest, the shortest and longest periods elapsing before dropping being 61 and 660 days, respectively. At least 94 days elapsed before any broom produced sporophores. The maximum mushroom production by one broom before dropping was 215, and they were produced every month, but principally in December to February. It was found that sporophores might develop on the site from which the broom had been removed if excision had not been properly carried out. From the middle of 1928 the disease has spread continuously, usually from infected to adjacent estates; in some cases, however, jumps of 5 to 25 miles occurred. The first infection in an estate is probably always air-borne.

During the year the witchbroom staff (chief supervisor, assistant supervisor, and 25 assistant inspectors) paid 22,736 visits to inspect new properties and to advise on control measures. Under the powers granted by the Plant Protection Ordinance [cf. ibid., viii, p. 160] 385 orders were issued, compulsory measures enforced on 27 estates, and 10 owners prosecuted. By the end of December 1931, some 100,000 acres (half the cacao acreage) on 2,454 properties were infected or suspect. On an average, the number of infected trees is trebled annually, but this increase is much greater in wet areas. Appreciable losses have already been sustained in very wet, low-lying districts. Nitrogenous manuring increased infection; of the fungicides tested, Bordeaux mixture was the most useful.

DUPONT (P. R.). **Entomological and mycological notes.**—*Ann. Rept. Dept. of Agric. Seychelles, for the year 1931*, pp. 10–11, 1932.

The scale insect *Ischnaspis filiformis* continues to cause heavy damage in the Seychelles coco-nut plantations and is not appreciably held in check by its newly established parasite, *Pseudomicrocera* [*henningsii*: *R.A.M.*, x, p. 708]. This fungus, together with *Sphaerostilbe coccidophthora*, was found on *Aulacaspis pentagona*, a parasite of *Hibiscus mutabilis*. *Ganoderma lucidum* [ibid., xii, p. 76] is frequently found in coco-nut plantations where the beetle *Melitomma insulare* is prevalent, the former possibly acting as a forerunner of the latter.

**Fifty-fourth Annual Report of the North Carolina Agricultural Experiment Station for the fiscal year ending June 30, 1931. Progress Report for year ending December 1, 1931.**—130 pp., 11 figs., (?) 1932. [Received December, 1932.]

Summarizing the work of the Division of Plant Pathology (pp. 67–76), S. G. Lehman furnishes the following among other information.

Satisfactory control of loose smut of oats [*Ustilago avenae*] was given by smuttox [ibid., xi, p. 634], especially when the seed was stored in a tight receptacle for 48 hours after treatment. Ceresan (the active ingredient of which is ethyl mercury chloride) reduced the incidence of infection to below 1 as against 17·6 per cent. in the untreated controls. The planting of 29th October, in which 17·6 per cent. smut occurred, was immediately followed by

rain that kept the soil wet for a week or more, the mean maximum and minimum temperatures for ten days after planting being 55·9° and 38·4° F., respectively. The planting of 24th November, on the other hand, was succeeded by a dry week and the maximum and minimum temperatures were 48·4° and 29·3°, respectively, resulting in under 0·2 per cent. smut.

When tobacco plants were set in soil heavily infested with the mosaic virus so that only the crown was in contact with the earth, not more than 2 out of 38 plants became diseased, while no symptoms appeared when the roots alone were in contact with the soil. Evidently, therefore, the virus does not readily enter the plants through the root system. No infection developed on plants with uninjured roots immersed for 48 hours in the virus, or on those similarly immersed after the severance of the small rootlets, but rather more than half of those exposed to infection after cutting the larger rootlets contracted the disease. The percentage of mosaic was lower in tobacco stands where the stalks and roots were thoroughly disked in the autumn than where they were left over winter and ploughed under in the spring.

A new brown root rot disease of tobacco occurring in alkaline soils was found to be associated with *Fusarium* and *Aspergillus* spp. as well as a Phycomycete, not yet identified, but the primary cause is believed to be the nematode *Tylenchus pratensis*.

R. F. Poole contributes the following items (pp. 76–89). The best control of bacterial spot of peach (*Bacterium pruni*) was given by finishing lime (25–50), which reduced the total infection from 47·7 to 17 per cent. The greatest reduction of severe infection (14·9 to 1·6 per cent.), however, was given by zinc-lime (8–8–50) [ibid., xi, p. 660]. Good control of brown rot (*Sclerotinia fructicola*) [*S. americana*: ibid., xii, p. 11] on the Hale and other peach varieties ripening early in August was given by colloidal sulphur (up to 15–50) and zinc sulphate with lime, while lime alone and potassium permanganate delayed infection.

Dewberry [*Rubus* sp.] plants pruned just below the soil in 1929 and 1930 showed 0·4 per cent. canes killed by *Leptosphaeria coniothyrium* [ibid., x, p. 164] as compared with 10·9 per cent. on those cut by hoes, some below and some above the soil, leaving long spurs exposed. Plants pruned just below the soil in 1930 showed 1·4 per cent. dead canes, while in those pruned high the incidence of mortality due to the fungus was 43·8 per cent.

*Bact. solanacearum*, the causal organism of tobacco wilt, was found to tolerate a hydrogen-ion concentration of $P_H$ 4·8, the soil reaction where the disease was most severe being equal to $P_H$ 5·0. The incidence of black shank (*Phytophthora* [*parasitica*] *nicotianae*) [ibid., xii, p. 118] was reduced by between 11 to 17·5 per cent. by soil treatments with various copper and sulphur compounds.

In a study on the varietal reaction of sweet potatoes to scurf (*Monilochaetes infuscans*) [ibid., xi, p. 535], the Norton Yam showed only 4·4 per cent. slight and 3 per cent. severe infection, the corresponding figures for White Jersey being 77 and 45·7 per cent., for Red Jersey 73·3 and 45·2, and for Nancy Hall 74·5 and 42·9, respectively. The apparent resistance of the first-named variety is attributed to the long distance of the potatoes from the

stem. A sweet potato root rot resembling mottle necrosis [ibid., vi, pp. 506, 748], but evidently distinct, occurs on the light sandy soils of Currituck County, the Jersey varieties being most susceptible.

**Biennial Report of the North Carolina Department of Agriculture from July 1, 1930 to June 30, 1932.**—120 pp., 9 figs., 1932.

The following items of phytopathological interest occur in this report. In the early spring of 1932 there was a very severe epidemic of blue mould [*Peronospora hyoscyami*: *R.A.M.*, xi, p. 806] in the tobacco seed-beds, not only of the Oxford Station but throughout the flue-cured area. Bordeaux mixture 2–3–50 and 3–4–50 checked the spread of infection but simultaneously retarded the growth of the plants.

Out of 107 varieties and selections of tobacco planted in Forsyth County for black shank [*Phytophthora parasitica nicotianae*: see preceding abstract] observations, four gave promising results in 1931. Two of these were hybrids of the fire-cured Greenwood crossed on Dark Greenwood and York, the last named being a flue-cured variety, showing about 30 per cent. resistance. In 1932 five selections of cigar tobacco have shown almost 100 per cent. resistance; they were crossed with flue-cured selections and will be grown during 1933. Resistance to black root rot (*Thielavia*) [*basicola*] has been shown by selections of Paris Wrapper and Jamaica, both good flue-cured selections.

'Sand drown' was found to occur on all the tobacco plots in a fertilization scheme except those given magnesium limestone (dolomite) at the rate of 20 lb. per acre, or magnesium-potassium sulphate [ibid., xi, p. 471].

During the summer of 1931, 284 commercial peach orchards containing 1,680,386 trees were inspected, in addition to a number of home orchards, 12 phony trees being found in 8 commercial and 10 in home orchards [ibid., xi, p. 543]. All the diseased trees were cut down. In 1932 only one phony tree was found among 119,982 in 25 commercial orchards, while 17 were detected in 13 home orchards containing 163 trees in the Wadesboro district.

Bugnicourt (F.). **Travaux de cryptogamie.** [Cryptogamic work.] —ex Rapport sur le fonctionnement de la Division de Phytopathologie pendant l'année 1931. (Section sud-indochinoise de l'Institut de Recherches agronomiques.)—*Bull. Écon. Indochine*, N.S., xxxv, pp. 476B–514B, 1932.

Notes are given on a number of rice diseases occurring in Indo-China during 1931, including those due to *Helminthosporium oryzae* [*R.A.M.*, xi, p. 433], *H. sigmoideum* [ibid., xi, p. 469], *Brachysporium* sp. [ibid., x, p. 542], *Nigrospora oryzae* [ibid., vi, p. 758], *Sporotrichum* sp., *Clasterosporium* sp., *Fusarium* sp., *Cladosporium oryzae*, *Sclerotium oryzae* [ibid., xi, p. 433], two fungi with medium-sized and large sclerotia, respectively, and *S. rolfsii* [ibid., vii, p. 541].

*N. oryzae* is stated to cause a black discoloration of rice glumes and peduncles and sterility of the grains, the leaves being also affected.

The above-mentioned species of *Clasterosporium* has cylindrical,

echinulate, brown, biseptate conidia, 14 to 18 by 7 to 9 $\mu$, rounded at the extremities, slightly constricted at the septa, and borne on minute, hyaline conidiophores. The fungus forms circular, reddish-grey, brown-edged spots, 1 to 2 mm. in diameter, on the leaves, and was subsequently observed producing very thick, greenish-brown cushions on the grains of an early maturing rice variety.

*Cladosporium oryzae* Miyake (*C. miyake* Sacc. & Trott.) forms minute, brown spots on the leaves in lines parallel with the veins. The affected foliage turns yellow, shrivels, and becomes covered with the greenish, powdery conidia. Affected plants are frequently killed.

The fungus with medium-sized sclerotia (0·5 mm. or more in diameter) causes a rot of the stem bases equally severe with that due to *S. oryzae*. In contrast to the latter, the sclerotia are always produced on the surface of the leaf sheaths at a distance of 10 to 15 cm. from the base, and not within them. The organism with large sclerotia (1 to 2 mm. in diameter) appears merely to weaken the plants without causing actual decay. The dirty- to yellowish-white sclerotia fuse into large, irregular masses on the outside of the stem bases. These two sclerotial fungi are thought to be possibly species of *Corticium*.

Among the numerous other interesting items the following may be mentioned. *Massaria theicola* [ibid., iii, p. 4] is a wound parasite of tea stems, branches, and twigs, causing severe die-back and a reddish-brown discoloration of the tissues. Perithecia, asci, and ascospores, developed in culture, exactly agreed with the description of *M. theicola*.

A species of *Fusarium* with spores measuring 60 to 70 by 7 to 8 $\mu$ caused a canker of tea branches in Annam.

*Discosia theae* [ibid., viii, p. 814] produces dark grey or brownish spots on the leaves of tea bushes. Under damp conditions the flattened, black pycnidia rapidly develop and give rise to very characteristic, minute pycnospores.

A species of *Fusarium* with curved, hyaline, 3- to 5-septate spores, measuring 32 to 42 by 4 to 4·5 $\mu$, was isolated from the small, round, whitish pustules on the roots and stems of Ledgeriana, Malabar, and Succirubra *Cinchona* plants suffering from canker [ibid., xi, p. 433]. In a humid atmosphere the diseased material developed spherical, reddish-orange perithecia with a distinctly red papilla, containing asci with eight uniseptate, hyaline ascospores, rounded at both ends, constricted at the septum, and measuring 14 by 6 $\mu$. The fungus, which is believed to be a species of *Nectria*, is responsible for heavy losses in *Cinchona* nurseries.

*Cinchona* seedlings (from eight months to a year old) further suffer from a wilt and black discoloration of the tips that may spread to the lower parts and cause the death of the plants. A species of *Gloeosporium* with hyaline, roughly cylindrical conidia, swollen at the tip and slightly constricted in the middle, 15 by 4·5 $\mu$, was isolated from diseased organs, and is thought to be disseminated by the use of infected seed. A closely related species of *Gloeosporium* causes an anthracnose of *Cinchona* seedlings, the leaves of which show reddish-yellow lesions that gradually extend the whole length of the branch.

A species of *Fusarium* with 3- to 5-septate spores, measuring 24 to 30 by 3·5 to 5 $\mu$, was isolated from long, deep furrows in the collars of two-year-old Arabica coffee plants in Tonkin.

Coco-nut palms are subject to a desiccation of the peduncles of the nuts leading to the fall of the latter. Fissures are generally apparent in the husks, from which gum exudes. Two fungi appear to be involved in the causation of this disease, namely, *Botryodiplodia theobromae* [ibid., iv, p. 35] and a species of *Gloeosporium*, the latter probably inducing the gummosis.

Control measures against most of these diseases are briefly indicated.

KLEIN (G.) & KEYSSNER (E.). **Beiträge zum Chemismus pflanzlicher Tumoren. I. Mitteilung: Stickstoffbilanz. II. Mitteilung: Über die Wasserstoffionen Konzentration in pflanzlichen Tumoren.** [Contributions to the chemistry of plant tumours. Note I: Nitrogen balance. Note II: On the hydrogen-ion concentration in plant tumours.]—*Biochem. Zeitschr.*, ccliv, 4–6, pp. 251–263, 1932.

Analytical studies [the data from which are tabulated] on the tissue contents of the tumours caused by *Bacterium tumefaciens* in beet, balsam [*Impatiens balsamina*], geranium (*Pelargonium*), and tomato showed in all cases a marked excess of albumin over that present in the healthy tissues. The ammonia, amino acid, and amide contents of the tumours were found to be higher than the normal in balsam, geranium, and tomato, and lower in the beets.

The reaction of the tumours was generally more alkaline than that of the healthy plants (those mentioned above with the addition of cucumber and sunflower) [*R.A.M.*, vi, p. 19].

KLEIN (G.) & ZIESE (W.). **Beiträge zum Chemismus pflanzlicher Tumoren. III. Mitteilung: Der Katalasegehalt von pflanzlichen Tumoren im Vergleich zum Katalasegehalt gesunden Pflanzengewebes.** [Contributions to the chemistry of plant tumours. Note III: The catalase content of plant tumours in comparison with that of healthy plant tissue.]—*Biochem. Zeitschr.*, ccliv, 4–6, pp. 264–285, 1 fig., 17 graphs, 1932.

The catalytic activity [full details of the method of estimation of which are given] in extracts of normal sugar and fodder beets was found to be much lower than that in extracts from tumours produced by *Bacterium tumefaciens* in these plants [*R.A.M.*, vii, p. 78, and preceding abstract]. A similar phenomenon was observed, to a lesser extent, in the tumours of *Pelargonium*, sunflower, *Sedum*, tomato, and balsam [*Impatiens balsamina*]. The optimum hydrogen-ion concentration for catalytic activity was found to lie between $P_H$ 6·5 and 7.

No evidence was obtained that the bacteria themselves or substances engendered by them were directly responsible for this access of catalytic activity, although the manifestation was shown (in tumours on *Canavalia ensiformis*) to be specific to infected tissue, as distinct from normal callus. The tumours induced by

inoculation with various strains of *Bact. tumefaciens* did not differ in catalytic activity or other respects.

PASSMORE (F. R.). **A survey of damage by insects and moulds to West African Cacao before storage in Europe. Season 1930–31.**—*Bull. Imper. Inst.*, xxx, 3, pp. 296–305, 1932.

In connexion with an investigation by the Stored Products Research Branch of the Imperial College of Science and Technology on the mould spoilage of warehouse stocks, it was found that the average cacao shipped from the Gold Coast comes well within the Liverpool official grade 'A, good fermented', which allows 5 per cent. 'slatey' and 5 per cent. defective beans. Little or no correlation was observed between the moisture content of cacao when landed and the number of mouldy beans present. For instance, there were 3·2 per cent. mouldy beans in a consignment with a moisture content of 8·2 per cent. (the highest recorded in this series of observations) and 4·2 per cent. in one with the lowest moisture content of 6·6 per cent. Dade has shown [*R.A.M.*, ix, p. 164; xi, p. 703] that cacao dried to (and kept at) about 8 per cent. moisture is safe from moulds of the *Aspergillus glaucus* group, considered to be the most prevalent of the organisms growing in the interior of commercially dry cacao [cf. ibid., xi, p. 30; xii, p. 47]. It is evident, therefore, that Gold Coast cacao landed in England is not liable to further moulding unless stored under damp conditions (87 per cent. relative humidity) for prolonged periods, in which case the moisture content may rise to 9·5 per cent.

The following fungi, not hitherto reported as moulds occurring in Gold Coast cacao, have been isolated in the course of these investigations: *A. gracilis*, *A. repens*, *A. ruber*, *A. sydowi*, *A. terreus*, *Syncephalastrum cinereum*, *Scopulariopsis* sp., *Sporotrichum flavicans* var., *Penicillium citrinum* (or var.), *Actinomyces cacaoi*, I, II, and III, and *Cylindrocarpon* (*Fusarium*) sp. The three variants of *A. cacaoi* (named by Dr. S. Waksman) were isolated from the only musty sample examined, which came from Nigeria.

VOELKEL [H.]. **Die starken Schäden an Getreide im Jahre 1932.** [The heavy damage to cereals in the year 1932.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xii, 10, pp. 79–80; 11, pp. 89–90, 8 maps, 1932.

During 1932 yellow rust (*Puccinia glumarum*) attacked barley severely in Saxony and wheat in Oldenburg and Thuringia. Brown rust caused heavy damage on barley [*P. anomala*] in Lower Franconia, on rye [*P. secalina*] in Hanover and Württemberg, and on wheat [*P. triticina*] in Hanover, Oldenburg, Silesia, Saxony, Thuringia, Baden, Württemberg, and Bavaria. Wheat was extensively attacked by black rust (*P. graminis*) in East Prussia, Lower Silesia, and elsewhere, rye in Schleswig-Holstein and East Prussia, barley in East Prussia and Württemberg, and oats in Hanover. The reduction of the wheat yield from black rust in the Breslau district (where infection was general following clover) is estimated at 25 to 50 per cent. and in one locality of Schleswig-Holstein at 80 per cent. Crown rust of oats (*P.*

*coronifera* and *P. coronata*) [*P. lolii*] was very severe and widespread in East Prussia. The foot rots (*Leptosphaeria herpotrichoides*, *Ophiobolus herpotrichus*, and *Fusarium* spp.) were widespread on wheat in North Germany, East Prussia, the Grenzmark, and Westphalia, rye being also severely infected in parts of Hanover, Mecklenburg, East Prussia, and the Grenzmark, while barley suffered relatively little. In the Grenzmark the disease was almost invariably observed following summer barley. So severe were the attacks of the snow mould (*F. nivale*) [*Calonectria graminicola*] on rye in parts of North Germany that areas up to 40 hect. in extent had to be ploughed up.

KLEMM. **Katastrophales Auftreten von Weizenrost in Südosteuropa.** [A catastrophic outbreak of Wheat rust in south-eastern Europe.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xii, 10, p. 81, 1932.

According to a series of reports in *Industrie und Handel* during July and August, 1932, the wheat crops in many districts of Poland, Bulgaria, and Rumania were decimated by rust [*Puccinia* spp.], resulting in a loss of 70 to 85 or even up to 100 per cent. of the harvest in some of the most prolific regions of the first-named country, e.g., Lublin, Cracow, and Lemberg. Barley and oats were also affected. In Bulgaria the fields bordering the Danube failed to yield sufficient for the seed requirements of the country, with the consequence that export was immediately prohibited. The weight of the Rumanian grain was reduced from 79 or 80 to between 62 and 70 kg. per hectol.

RIVIER (A.). **Quelques notations des rouilles du Blé.** [A few data on Wheat rusts.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 6–7, pp. 191–201, 4 graphs, 1932.

The two tables given in this paper show the relative intensity of attack (in numerical notations worked out by the evaluation method of Ducomet and Foëx) [*R.A.M.*, v, p. 349] of *Puccinia triticina* and *P. glumarum*, respectively, on eleven [named] varieties of wheat during each of the five years from 1927 to 1931 in the experimental field of the École Nationale d'Agriculture, Montpellier. The analysis of the results made by the author indicates that while certain varieties exhibit the same relative resistance or susceptibility to the rusts in different years, others vary from year to year, e.g., Touzelle rouge and Hâtif inversable which were severely rusted by *P. glumarum* in 1928 and showed considerable resistance in 1930, both bad rust years. Since in these two years no differences were observed in the amount of infective material present or in the rainfall during the critical period for infection, and since the highly susceptible Noë wheat was seriously rusted by *P. glumarum* in both years, the author believes that an explanation of this variation in relative resistance of certain varieties may be found in the different range of temperatures in the early spring; while in 1928 January and February were mild, following a cold December, in 1930 the coldest weather occurred in February, checking the vegetation of the wheat seedlings at a more advanced stage of development, and possibly bringing

about a change in the chemical constitution of the plants which rendered them more resistant to *P. glumarum*.

PETIT (A.). **Expériences préliminaires sur le traitement des rouilles du Blé.** [Preliminary experiments on the control of Wheat rusts.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 6–7, pp. 202–207, 1932.

In the experiments outlined in this paper, which were carried out in Tunis, wheat plants grown in pots were successfully protected from infection with yellow rust (*Puccinia glumarum*) and brown rust (*P. triticina*) by periodical sprayings with colloidal sulphur solutions or dusting either with precipitated sulphur or a mixture of 10 per cent. precipitated sulphur 'Codex', 1 per cent. cyanamide, 1 per cent. paraformaldehyde, and 88 per cent. lime. The protective action of the treatments is attributed both to a 'screening' effect of the fungicides which prevent the spores from reaching the leaf surface, and to their direct toxic effect on the spores. The indications so far are that the treatments should be repeated at regular intervals of 10 to 12 days, with a minimum of 4 or 5 applications per season; the minimum doses of the fungicides for each application have not yet been established.

JOHNSTON (C. O.) & MAINS (E. B.). **Studies on physiologic specialization in Puccinia triticina.**—*U.S. Dept. of Agric. Tech. Bull.* 313, 22 pp., 2 figs., 1932.

All the data concerning physiologic specialization in *Puccinia triticina* are assembled, and a key and a table of infection types for 53 physiologic forms are presented [*R.A.M.*, xii, p. 15]. A description is given of 39 physiologic forms occurring in North America. The previously unnamed differential wheat varieties, C.I. Nos. 3756, 3778, 3779, and 3747, used in the classification of physiologic forms, are named Carina, Brevit, Loros, and Similis, respectively, the last-named and Norka having been discarded as indicators on account of their resemblance to Webster and Malakoff, respectively [ibid., xi, p. 288]. Michigan Amber should also be excluded from the differential varieties by reason of its failure to react specifically to any of the physiologic forms. Certain physiologic forms, e.g., 9, 16, 31, and 37, are variable in their expression, some being apparently closely related members of integral groups that might be separated by the addition to the list of appropriate differential wheat varieties.

The distribution and prevalence of the physiologic forms in the United States appear to be independent of the occurrence of *Thalictrum* spp. Form 9 is more widespread and abundant in the Southern Great Plains (where it frequently overwinters) [ibid., viii, p. 491; x, p. 363] than other forms, but in the eastern section of the States forms 3 and 5 predominate. Form 2 was seldom isolated and occurred only over a small area in Kansas and Colorado, while 6, 10, and 11 also seem to be relatively unimportant. Of the forms described by Scheibe in Europe [ibid., ix, p. 767], only 11, 15, and 20 were encountered in these studies, the first in Washington, Idaho, Oregon, Texas, and Kansas, the second in Iowa and North Dakota, and the third in Texas and

Kansas. Forms 34 to 52, inclusive, have so far been found only in the Mississippi Valley and the eastern Plains States from Texas and Tennessee northward. Collections made in the late autumn, winter, and early spring in Kansas, Oklahoma, and Texas usually consist of form 9.

SCHMIDT (E.). **Nachweis von Quecksilber an gebeiztem Getreide.** [The detection of mercury in disinfected cereal seed-grain.]—*Fortschr. der Landw.*, vii, 19, pp. 481–483, 1 fig., 1932.

A further simplification of the electrolytic apparatus recently described for the detection of mercury and other heavy metals in disinfected cereal seed-grain [*R.A.M.*, xi, p. 706] has been introduced by the substitution of sodium thiosulphate for sodium chloride, thereby obviating the necessity for preliminary treatment with sulphuric acid. Tests with this apparatus resulted in the detection of varying amounts of mercury (estimated by the degree of oxidation of the aluminium electrode) in rye seed-grain treated with 0·25 per cent. germisan (sprinkle) for 15 or 30 minutes at 19° C., uspulun-universal 0·5 (sprinkle) and 0·2 per cent. (immersion) for 15 minutes at 18° or 19°, roggen-fusariol 0·15 (sprinkle) and 0·075 per cent. (immersion) for 15 minutes at 35° or 19°, and with the dusts abavit for 15 or 30 minutes at 19°, ceresan for 1 hour at 19°, trocken-fusariol for 15 or 30 minutes at 30°, and tutan for 90 minutes at 19°. It was further detected in wheat seed-grain immersed for 15 minutes in 0·16 per cent. weizen-fusariol at 30° or dusted for 30 minutes with tutan at 35°. No mercury was found, however, in rye seed-grain treated with tillantin or tutan for 30 minutes at 19°, or in wheat dusted with tutan for 15 minutes at 35°.

BECKER (K. E.). **Sparmassnahmen bei der Getreidebeizung.** [Economies in cereal disinfection.]—*Deutsche Landw. Presse*, lix, 43, p. 538, 1932.

Figures are given showing the present costs of the treatment of cereal seed-grain with the four so-called 'universal' disinfectants, viz., ceresan, germisan, and uspulun-universal liquids, and ceresan dust, all applicable against wheat bunt [*Tilletia caries* and *T. foetens*], snow mould of rye [*Calonectria graminicola*], stripe disease of barley [*Helminthosporium gramineum*], and loose smut of oats [*Ustilago avenae*: *R.A.M.*. xii, p. 84]. The cost of dusting 50 cwt. of wheat seed-grain with ceresan is Pf. 42 per cwt., the corresponding figures for the short disinfection process being 23 to 35, sprinkling 26 to 29, and immersion 10 to 12·5. There is thus a difference of some M. 16 between the cost of dusting 50 cwt. and that of the cheapest (and equally effective) immersion treatment. For rye the relative costs are similar, while for barley they are considerably higher, viz., dusting Pf. 62, short disinfection 39 to 44, sprinkling 32, and immersion 10·5 to 15, making a difference between dusting and immersion of M. 25·87. For oats the figures are as follows: dusting M. 1·03, short disinfection Pf. 74 to 94, and immersion 18 to 31·5. The last-named method, however, is impracticable on a large scale and sprinkling ineffectual.

PETIT (A.). **Nouvelles observations sur le traitement de la carie du Blé (Tilletia levis Kühn), du charbon de l'Orge (Ustilago hordei Persoon, Kellerman et Swingle) et du charbon de l'Avoine (Ustilago avenae Persoon, Kellerman et Swingle).** [New observations on the control of Wheat bunt (*Tilletia levis* Kühn), covered smut (*Ustilago hordei*, Persoon, Kellerman & Swingle) of Barley, and loose smut (*U. avenae* Persoon, Kellerman & Swingle) of Oats.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 6–7, pp. 208–213, 1932.

As a result of experiments carried out in Tunis in 1931, the author states that good commercial control of Wheat bunt (*Tilletia levis*) [*T. foetens*], covered smut (*Ustilago hordei*) of barley, and loose smut (*U. avenae*) of oats is afforded by dusting the seed-grain with cuprous chloride at the rate of 350 gm. per quintal [50 kg.] of seed, or with a powder containing from 10 to 15 per cent. bihydrated cupric chloride ($CuCl_2$ $2H_2O$) at the same rate [*R.A.M.*, xi, p. 552]. The addition of 5 per cent. of a mercury salt renders the dusts protective against insect attack on the seed-grain. He further believes that where varieties of cereals resistant to the smuts are sown and the degree of smut contamination is not great, the seed-grain may safely be disinfected with a powder containing as little as 5 per cent. of the cupric chloride and applied only once in every two or three years. Dusting the seed-grain with polymerized forms of formaldehyde long before sowing is deprecated as injurious to the resulting seedlings.

PICHLER (F.). **Kalkstickstoff als Staubbeize gegen Weizensteinbrand?** [Calcium cyanamide as a disinfectant dust against Wheat bunt?]—*Deutsche Landw. Presse*, lix, 40, p. 503, 1932.

Following on the work of Feucht and previous investigators on the control of wheat bunt [*Tilletia caries* and *T. foetens*] in Germany by dusting with calcium cyanamide [*R.A.M.*, xi, p. 565], the writer conducted a series of field and laboratory experiments to determine the applicability or otherwise of this method to Austrian conditions. The seed-grain of Hainisch winter wheat was mixed for ten minutes in glass tubes with 5, 10, or 20 gm. of unoiled calcium cyanamide per kg. and planted out in three different localities on 8th and 30th October and 11th November, 1931. Laboratory tests had already shown that calcium cyanamide at the rate of 5 gm. per kg. is only partially effective against bunt and at the same time causes a reduction of germination, and the results of the field experiments [which are tabulated] were not such as to justify the use of this substance for fungicidal purposes.

MOURASHKINSKY (K. E.). Влияние различных источников спор **Tilletia tritici** и **T. levis** на пораженность Пшеницы головней. **II.** [Effect of the source of origin of *Tilletia tritici* and *T. levis* spores on the susceptibility of Wheat to infection with bunt. II.]—ex *Болезни зерновых культур* [*Diseases of Cereal crops*], issued by *Siberian Scient. Res. Institute for Cereal Industry*, Omsk, pp. 4–14, 1932.

The results of the experiments reported in this paper [which were made in continuation of the work described in a previous

communication: *R.A.M.*, vii, p. 434] showed that passage of a given strain of *Tilletia tritici* [*T. caries*] or *T. levis* [*T. foetens*] for five consecutive years through the same variety of wheat considerably increased the virulence of that strain to that host. This applied to all the varieties tested included in all the species of *Triticum*, with the exception of *T. durum* var. *hordeiforme* 010 and *T. persicum*, the susceptibility of which to the strains grown on them remained, for some unknown reason, practically unchanged throughout the experiments. The results [shown in tabular form] of cross-inoculations in 1930 and 1931 indicated further, in opposition to the provisional view previously expressed [loc. cit.], the existence of considerable variation in the response of any given variety to infection with strains grown on other varieties or species, the differences noticed in the reactions being not less than those observed in the case of different geographical or biological strains.

In the author's opinion, these results admit of two alternative explanations. Either the collections of bunt spores used in the initial inoculation experiments in 1925 consisted of a mixed population of different strains which, by continued passage through the same variety, was reduced through suppression of the less pathogenic strains to a single strain specialized to the given variety [ibid., xi, p. 500]; or the original virulence of the spore population to the variety was increased by the production, by hybridization and mutations, of new strains. In the light of the experiments the latter alternative appears to be the more probable one; otherwise it would be hard to explain such increases in infection percentages as that, for instance, shown by *T. dicoccum* (with *T. foetens*), which rose from 6·8 to 43·1 at the end of five years' passage of the original strain through this host; and if such is the case the problem of breeding varieties of wheat for resistance to bunt would be impossible of solution.

MOURASHKINSKY (K. E.). О методике определения пораженности Пшеницы мокрой головней. [On the determination of the degree of infection of Wheat with bunt.]—ex *Болезни зерновых культур* [*Diseases of Cereal crops*], issued by *Siberian Scient. Res. Institute for Cereal Industry*, Omsk, pp. 62–71, 1932.

The author points out that the usual method of determining the degree of infection of a wheat field with bunt [*Tilletia caries* and *T. levis*] by counts of infected plants does not represent the actual losses caused by the disease, which, as indicated in a previous communication [*R.A.M.*, v, p. 352], are considerably increased by the death, during their development, of a large percentage of the bunted plants. This was clearly demonstrated in experiments in 1931 and 1932 at Omsk, in which clean and artificially infected (with *T. caries*) lots of seed-grain of *Triticum vulgare* var. *caesium* were grown in parallel plots under strictly comparable conditions. At harvest time, the degree of infection of the plants was determined by the usual count of diseased plants in the plots (giving the 'apparent' loss), and also by counts of the number of normal plants in the plots raised from clean seed and in those raised from bunted seed, the difference in which represented the 'actual' loss.

In every case the difference between the 'apparent' and the 'actual' loss was very high, the latter, in one case, being as much as nine times the 'apparent' loss.

With a few exceptions (presumably due to local ecological conditions), the experiments also confirmed the generally admitted view that wheat sown late in the season is less liable to infection with bunt than that sown earlier, and that dense stands are more heavily attacked than thinner ones. There was also some indication that wheat plants growing on ridges exhibited a higher 'actual' and lower 'apparent' degree of infection than those growing in the furrows, especially in the very dry year, 1931. Applications of sulphate of ammonium, superphosphate, and a complete fertilizer did not affect the incidence of bunt, but applications of $K_2O$ alone at the rate of 45 kg. per hect. slightly increased both the apparent and actual infection. The apparent infection was highest on soil freshly broken from grass and lucerne and lowest on soil tilled for several years consecutively, the reverse being true for the actual infection.

DOBROMYSLOFF (P. N.). **Пораженность яровой Пшеницы мокрой головней при бороздовом и рядовом посевах.** [Degree of infection with bunt of spring Wheat grown in ridged as against flat rows.]—ex *Болезни зерновых культур* [*Diseases of Cereal crops*], issued by *Siberian Scient. Res. Institute for Cereal Industry*, Omsk, pp. 72–79, 2 graphs, 1932.

Details are given of experiments at Omsk in 1931 to test the effect of the method of cultivation (ridged or flat rows) on the susceptibility of wheat to infection with bunt [*Tilletia caries*]. The results [which are presented in graphical and tabular forms] showed that the 'apparent' infection was highest and the 'actual' infection [see preceding abstract] lowest in the flat rows, with the exception of the latest date of sowing, where both types of infection were higher in the ridged rows. These results would indicate that the flat method of wheat growing, under the local ecological conditions, is more favourable to the development of the disease during the early stages of growth than that of ridged rows.

SMITH (W. K.). **Reaction of Martin Wheat to three physiologic forms of Tilletia tritici.**—*Phytopath.*, xxii, 10, pp. 847–850, 2 figs., 1932.

The writer has shown elsewhere that the physiologic form T2 of *Tilletia tritici* [*T. caries*] is readily distinguishable from T1 and T3 by the reaction of Martin (C.I. 4463). The differences apparent in Martin between bunt-free culms and those infected by T3 are similar to those described by Barrus (*Phytopath.*, vi, p. 21, 1916) in respect of Dawson's Golden Chaff.

The following differences were apparent at maturity between T2 and T3 in a test at Pullman, Washington. Spikes infected by T2 are more lax than those attacked by T3; the average length of ten internodes in the middle of the head for the T2 group was $6{\cdot}93 \pm 0{\cdot}08$ cm. compared with $5{\cdot}72 \pm 0{\cdot}04$ cm. for the T3. The T2 smut balls do not protrude from the glumes, owing to their

very small size (0·5 to 3·5 mm. in length as against 4·5 to 6·5 mm. for those of T3), and contain a large proportion of apparently immature, thin-walled, distorted spores.

The reaction of Martin to T2 is considered to denote a form of resistance [cf. *R.A.M.*, xii, p. 85].

FLOR (H. H.), GAINES (E. F.), & SMITH (W. K.). **The effect of bunt on yield of Wheat.**—*Journ. Amer. Soc. Agron.*, xxiv, 10, pp. 778–784, 1932.

The effect of the wheat bunt (*Tilletia tritici*) [*T. caries*] load and of the percentage of smutted heads in the crop on yield was tested at Pullman, Washington, in 1929–30, using Hybrid 128 (C.I. No. 4512) as a susceptible variety, Turkey (C.I. No. 6175) as moderately susceptible, and Ridit (C.I. No. 6703) as resistant. The first named was susceptible to all seven physiologic forms composing the inoculum, including form 1 of *T. caries*, the most prevalent in the Pacific Northwest [*R.A.M.*, xii, p. 18, and preceding abstract]. Turkey was resistant to this form, but susceptible to five of the others, while Ridit was resistant to all the forms used in the tests. It was found that an average increase of 16·2 per cent. bunt with Hybrid 128 reduced the yield by 20·5 per cent., the corresponding figures for Turkey being 30·3 and 23·1, and for Ridit 1·13 and 11·3 per cent., respectively. In the last-named variety the reduction is probably due in part to the morphological reactions of the plants to infection, e.g., dwarfing of the culms, failure to head, and distortion and partial sterility of infected heads.

BRESSMAN (E. N.). **Lolium infected with bunt of Wheat.**—*Phytopath.*, xxii, 10, pp. 865–866, 1 fig., 1932.

Seed of *Lolium perenne* and *L. multiflorum* coated with an inoculum consisting of equal parts of the ten physiologic forms of wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] previously described by the writer [*R.A.M.*, xi, p. 33] yielded three smutted heads, one in the former and two in the latter species, containing spores typical of *T. foetens* in size, shape, and texture. When broken, the sori emitted an extremely strong odour characteristic of wheat bunt [ibid., xi, p. 775]. A number of other grasses [which are enumerated] were similarly inoculated with negative results. *T. lolii* Auersw., which has been described on *Lolium*, is thought to be possibly a form of wheat bunt related to *T. caries*. No reports of the spontaneous occurrence of bunt on *L. perenne* or *L. multiflorum* in Oregon are available.

BUSSE (G.). **Pflanzenkrankheiten — Fruchtfolge und Düngung.** [Plant diseases—crop rotation and manuring.]—*Deutsche Landw. Presse*, lix, 42, p. 526, 1932.

In order to counteract the ravages of foot rot [chiefly *Ophiobolus graminis*: *R.A.M.*, xi, p. 775] in the German wheat stands, the writer recommends lucerne or oats as preceding crops. Stable manure should be applied to the oat stubble, and caustic lime strewn over the field at the rate of 1 to 1·5 doppelzentner per ¼ hect. a week before sowing the wheat.

FEISTRITZER (W.). **Haben die neueren Untersuchungsergebnisse über Fusskrankheit einen Einfluss auf die Sortenwahl?** [Have the results of recent investigations on foot rot an influence on varietal selection?]—*Mitt. Deutsch. Landw.-Gesellsch.*, xlvii, 44, pp. 791–793, 3 graphs, 1932.

An account is given of the writer's recent experiments (1930–1 and 1931–2) at Kleinwanzleben [Saxony] on the possibilities of combating the foot rots of cereals (caused to the extent of 75 per cent. by *Fusarium* spp. and 25 per cent. by *Ophiobolus* [*graminis* and *herpotrichus*] and *Leptosphaeria* [*herpotrichoides*] in the locality named) [*R.A.M.*, xii, p. 19] by attention to cultural practices, viz., field preparation, time of sowing, and crop rotation.

A severely infested plot was divided into four parts, of which one was hoed and after 14 days ploughed to a depth of 24 cm.; the second turned with a disk-harrow and then similarly ploughed; while the third and fourth were ploughed immediately from the stubble to depths of 24 and 34 cm., respectively. Each plot was sown with the same varieties under identical conditions for the purpose of comparative observations. On both wheat (Rimpau's Hybrid and Carsten V winter and Heine's Kolben and Peragis summer) and barley (Friedrichswerther and Peragis winter and Heine's Hanna and Isaria summer) the incidence of infection was greatly reduced (from 11·4 to 19·3 per cent.) by immediate deep ploughing under of the stubble, giving an increased yield, which with the winter cereals ranged from 8 to 10 doppelzentner per hect. In both years there was a decline of foot rot in the later sown winter wheat stands (end of November and early December), especially where potatoes were grown as the preceding crop. The sequence of winter wheat and winter barley is undesirable, but even in this rotation a decrease of infection may be obtained by a combination of late sowing and deep ploughing immediately after harvest. The course of the disease did not appear to be influenced by any of the synthetic fertilizers used in the tests. The deep cultivation, however, led to too luxuriant growth in the early stages and this tended to increase both lodging and foot rot, so that it is necessary to be sparing in the use of nitrogen and to grow varieties that are naturally resistant to lodging.

GUYOT (A. L.). **De l'évolution du piétin des céréales en rapport avec certains facteurs météorologiques.** [The development of foot rot of cereals in relationship to certain meteorological factors.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 6–7, pp. 215–228, 3 graphs, 3 diags., 1932.

In the study reported in this paper of the seasonal development of foot rot of cereals [*Ophiobolus graminis*, *Cercosporella herpotrichoides*, *Leptosphaeria herpotrichoides*, *Wojnowicia graminis*, and *Fusarium culmorum*: *R.A.M.*, ix, p. 641; xi, p. 503] in France, use was made of the fact that the sulphuric acid treatment recommended for the control of the disease [ibid., vi, p. 403], by killing the infected tissues of the host plant, has a fixing effect on the parasitic organisms, this allowing of the study at leisure of the stage attained in their development at the moment of the treatment. The results of histological examinations in 1925 in

Picardy, and in 1929 and 1931 in the neighbourhood of Paris, of cereal plants thus treated at different dates (from the beginning of March to the middle of May), taken in conjunction with the meteorological data for the periods preceding the treatment, indicated that in each of the years under review the development of foot rot could be differentiated into two periods, each covering some 120 days, which the author terms 'quiescent' ('calme') and 'critical', respectively. From the meteorological standpoint, each of these periods was characterized as follows. During the quiescent period the rainfall never exceeded 7 mm. for any interval of 6 consecutive days, with an average of 2·4 mm., and sunshine was in every case over 18 hours during the same interval, with an average of 39·3 hours. During the critical period, on the other hand, in 50 per cent. of the cases rainfall exceeded 10 mm. during any 6 consecutive days, with an average of 12·6 mm., and sunshine was on an average 25 hours and was below 18 in 50 per cent. of the periods. These observations support the opinion previously arrived at that prolonged rains and overcast weather favour the development of foot rot of cereals, and are believed to throw further light on certain obscure points in the etiology of the disease.

GRAHN. **Haben wir die Gefahr und Bekämpfung des Weizenhalmtöters richtig erkannt?** [Have we correctly recognized the danger and need for control of the Wheat strawbreaker?] —*Deutsche Landw. Presse*, lix, 43, pp. 537–538, 1932.

Heavy damage is stated to be caused in Mecklenburg and Schleswig-Holstein by the wheat strawbreaker (*Ophiobolus herpotrichus*) [*R.A.M.*, ix, p. 448; xi, pp. 495, 503]. The foot rot caused by this fungus is generally absent or of little importance where a beet-oats-wheat crop rotation is practised. In a stand under the writer's observation (two-thirds following Victoria peas and one-third beans) the former portion remained healthy, while some 25 per cent. of the latter was destroyed by *O. herpotrichus*. The answers to a *questionnaire* intended to elicit information as to the conditions favouring infection by the strawbreaker were so conflicting as to necessitate further investigations on this very acute problem.

SCHAFFNIT (E.). **Zu den bisherigen Ernteschäden durch Lagern des Weizens.** [On the crop losses hitherto sustained through lodging of Wheat.]—*Deutsche Landw. Presse*, lix, 43, pp. 535–536, 2 figs., 1932.

In May, 1932, the writer isolated at Bonn a fungus, hitherto not reported in Germany, from the elongated-oval, pale, brown-edged lesions on wheat haulms affected by the 'straw-breaking' as opposed to the 'blackleg' form of parasitic lodging [cf. *R.A.M.*, xi, p. 444 and preceding abstracts]. *Fusarium culmorum* and *F. nivale* [*Calonectria graminicola*] frequently occur in a secondary capacity on the diseased plants. Heavy losses may be caused by the newly detected parasite, which reduced the yield on a well-known estate in Saxony from 18·70 cwt. per $\frac{1}{4}$ hect. on a healthy plot to 13·45 cwt. on a diseased one, while only 7 cwt. per $\frac{1}{4}$ hect.

was harvested on a badly affected area in the Cologne district. The disease occurs with particular severity in wheat crops following peas. Cultural measures tending to diminish infection are briefly indicated.

SAMUEL (G.) & GARRETT (S. D.). **Rhizoctonia solani on cereals in South Australia.**—*Phytopath.*, xxii, 10, pp. 827–836, 2 figs., 2 graphs, 1 map, 1932.

Wheat, oats, barley, and pasture plants (grasses and others) on the so-called 'mallee' (dwarf *Eucalyptus*) soils of South Australia are affected by a seedling disease caused by *Rhizoctonia* [*Corticium*] *solani*, a preliminary note on which has already appeared [*R.A.M.*, viii, p. 96]. The soils under observation are usually characterized by alternating sand ridges and red loam flats overlying a shallow limestone, with a strongly alkaline reaction ($P_H$ 8 to 9) and an average annual rainfall of 12 to 18 in.

The most conspicuous symptoms occur on the roots, the tips or intermediate portions of which are so severely attacked that they lose all turgidity and assume a flaccid, water-soaked appearance. The cortex soon rots away and the central cylinder breaks, leaving nothing but a brown stump. The fungus isolated from the diseased plants was compared with three strains of *C. solani* from potatoes and readily identified as the same species. In the early stages, when isolations are most easily made, the cortical tissues are full of the stout, hyaline, intracellular hyphae, 10 $\mu$ in diameter, but with the disintegration of the tissue only the long, slender, brown, distributive hyphae, 7 $\mu$ in diameter, can be discerned. The maximum, optimum, and minimum temperatures for the growth of both the potato and cereal strains of *C. solani* were 32°, 23° to 26°, and 4° C., respectively. The potato strain showed a slightly less acid optimum reaction than the cereal ($P_H$ 6·5 to 7 as against 6 to 6·5). Cross-inoculation experiments with the wheat and potato strains indicated that both hosts may be attacked by either strain, as already shown by Rayllo in Russia [ibid., vi, p. 747]. It was demonstrated by experiments (in Wisconsin soil temperature tanks) that the infection of Federation wheat by *C. solani* was most severe at a range of 12° to 17°, the effects at higher temperatures being almost imperceptible.

PUGH (GRACE W.), JOHANN (HELEN), & DICKSON (J. G.). **Relation of the semipermeable membranes of the Wheat kernel to infection by Gibberella saubinetii.**—*Journ. Agric. Res.*, xlv, 10, pp. 609–626, 8 figs., 1932.

This is a detailed and fully illustrated account of the authors' investigation (based on the examination of naturally and artificially infected material in 1923 and 1924) of the mechanism of infection of wheat grains by *Gibberella saubinetii* in relation to the structure of the grains at different stages of maturity. In infections at flowering time the fungus penetrates readily at the brush end of the grain, the hyphae advancing from the infected anthers to the ovary. At that stage the membranes of the testa are thin, and give poor protection to the young seed against invasion by the fungus, with the result that a high percentage of the grains are so

badly diseased as to be practically worthless. With advancing age the testa becomes increasingly resistant to penetration by *G. saubinetii*, the degree of resistance of its various membranes being apparently proportional to their thickness, and the outer, semi-permeable membrane being the most resistant. In wheat grains infected at maturity, the parasite is usually localized at the embryo end, and is sparse in the testa, nucellar layer, and endosperm. The aleurone cells may be filled with hyphae for considerable distances along the groove, for a shorter distance on the dorsal side, and a still shorter distance on the flanks. The embryo is more or less completely permeated by the hyphae. The penetration and spread of the fungus inside the wheat grain are apparently greatly influenced by the location and structure of the protective parts, especially the layers of the testa, and also by the distribution of water within the grain.

ZILING (M. K.). ,,Черный зародыш'' Пшеницы. ['Black germ' of Wheat.]—ex *Болезни зерновых культур.* [*Diseases of Cereal Crops*], issued by *Siberian Scient. Res. Institute for Cereal Industry*, Omsk, pp. 15–39, 1932.

The author states that a condition of wheat grains very similar to that known in Italy as 'puntatura' [*R.A.M.*, v, p. 663] and to that described from Morocco as 'moucheture' [ibid., x, pp. 20, 21], is known to have occurred in Siberia at least since 1914. Increased incidence of the trouble of recent years (especially in 1932, presumably owing to the very wet conditions of that year), induced him to undertake an extensive survey, which showed that the disease is widespread over the whole of Siberia and the Russian Far East, and that *durum* wheats are considerably more affected by it than those of the *vulgare* group. Isolations from diseased grains germinated on filter paper yielded *Alternaria tenuis* in 82 to 95 per cent., *Helminthosporium sativum* in 15 to 60 per cent., *Fusarium* spp. in about 4 per cent., and a number of unidentified fungi in some 2 per cent. of the cases. Bacteria were not present.

Macroscopically, wheat grains infected with *A. tenuis* are readily distinguishable from those infected with *H. sativum* in that the former are usually larger and heavier, while the latter are smaller and lighter than normal. Further, in infection with *A. tenuis*, the brown discoloration, of varying intensity, is limited to the embryo region, with a narrow brown line extending along the groove up to the brush end; the mycelium is usually located in the pericarp, penetrating to the integument (more rarely to the aleurone layer and very exceptionally to the endosperm), but never entering the germ. When *H. sativum* is concerned, the external brown discoloration may extend to other portions of the grain; the mycelium permeates both the pericarp and the endosperm, and not infrequently also attacks the germ which, in severe cases, may be mummified.

Further studies showed that under controlled conditions the germinability of infected seeds was reduced by 2·4 per cent. in *A. tenuis* and by 33·3 per cent. in *H. sativum* infections. The viability of the grains attacked by *Fusarium* spp. was reduced by 50 per cent. The content of the grains in nitrogen, fatty substance,

and gluten was affected by the two common fungi differently. As indicated by experiments in 1931 and 1932 near Omsk, the incidence of the disease caused by both organisms was but slightly affected by the nature of the soil, preceding crop, or fertilizers used. Of the two fungi *H. sativum* appears to be the more dangerous, and work is in hand to find control measures against it.

MAIER-BODE. **Unterlassung der Beizung gilt als Fahrlässigkeit.** [The omission of disinfection counts as negligence.]—*Deutsche Landw. Presse*, lix, 43, p. 538, 1932.

The occurrence of stripe disease of barley [*Helminthosporium gramineum*] and bunt of wheat [*Tilletia caries* and *T. foetens*] on a German estate which had recently changed hands was adjudged by the receiving commission to be due to negligence in the omission of seed-grain disinfection on the part of the former owner, from whom compensation was accordingly exacted. The loss in the barley crop was estimated at 4 cwt. per $\frac{1}{4}$ hect.

TAPKE (V. F.). **An undescribed loose smut of Barley.**—*Phytopath.*, xxii, 10, pp. 869–870, 1932.

Further studies at Washington, D.C., on the infection of barley by loose smut through seed inoculation [*R.A.M.*, iv, p. 271], have shown that the disease may be caused by either of two fungi, viz., *Ustilago nuda*, or a species with dark chocolate-brown spores for which the name *U. nigra* n. sp. is proposed. The spores of the new species measure 6·5 to 7 $\mu$ compared with 5·5 to 6 $\mu$ in *U. nuda*, and remain viable for eighteen months as against only three to six or occasionally twelve months in the latter. Complete control of *U. nigra* in plants from seed from inoculated flowers may be obtained by dusting the seed with ceresan or immersing it for 90 minutes in 1 in 320 formaldehyde, whereas this method is ineffectual against *U. nuda*. A further difference between the two forms of smut is that *U. nigra* can cause seedling infection through the inoculation of mature seed with spores, while *U. nuda* is unable to do so.

MAJDRAKOFF (P.). **Versuche mit der Streifenkrankheit der Gerste (Helminthosporium gramineum Rabh.) unter besonderer Berücksichtigung der Infektions-, Beiz- und Immunitätsfrage.** [Experiments with the stripe disease of Barley (*Helminthosporium gramineum* Rabh.) with special reference to the questions of inoculation, disinfection, and immunity.]—*Bot. Arch.*, xxxiv, 3–4, pp. 337–362, 2 diags., 1932. [English summary.]

Using an adaptation of the methods already worked out at Leipzig for studies on loose smut of oats [*Ustilago avenae*] and stripe disease of barley (*Helminthosporium gramineum*) [*R.A.M.*, v, p. 547; ix, p. 710; x, p. 92], the writer conducted a series of investigations on the latter disease.

Conidia for inoculum were obtained by knocking them off the infected leaves with beads or quartz grains. The beads or quartz particles should measure 3 to 4 mm. in diameter, their ratio to the

dried leaves being as 20 : 1 by weight. The conidia are separated by passing through two sieves, the first of 1·5 mm. diameter and the second of 0·15 mm., placed one above the other in a closed container and shaken for three to five minutes by a horizontal movement. Inoculation was successful when the seed-grain was immersed for one hour in a conidial suspension at room temperature and then transferred for three hours to an incubator at 25° to 28° C., with an atmospheric humidity of 90 to 100 per cent. Positive results were further obtained by one hour's immersion of the seed-grain in a conidial suspension at 25° without subsequent removal to the incubator. An increase in the infection percentages was obtained by the following measures: (*a*) multiplying the number of conidia in the suspension (up to 1 gm. per 100 c.c. of nutrient solution); (*b*) regulating the temperature during the germination of the seedlings, the highest percentage of infection being obtained usually at 4°, the next at 25°, and the lowest at 8·8°; (*c*) adjusting the soil moisture capacity to 30 or 90 per cent.; and (*d*) use of old seed-grain with reduced germinability. Temperature was found to be the most important of these factors.

The following procedure gave satisfactory results in varietal reaction and disinfection tests. The seed-grain is placed on fairly damp blotting-paper and exposed to a temperature of 4°. After germination (which generally takes seventeen days at this low temperature) the seedlings are planted out in boxes filled with a mixture of $\frac{1}{3}$ sand and $\frac{2}{3}$ soil, where they remain without further temperature adjustment until the ears are formed, when infection counts are made.

The best control of stripe disease, both in laboratory and field experiments, was given by thirty minutes' immersion in 0·125 per cent. germisan. Uspulun-universal (one hour at 0·25 per cent.) and tillantin dust (200 gm. per 50 kg.) were moderately efficacious, while formaldehyde gave very poor results.

In the varietal reaction trials a six-rowed Bulgarian form and Streng's winter barley proved highly resistant, while Bürckner's Silesian, Almerfelder, Eckendorfer Mammoth, Janetzki's early, and Engelen's medium-early were susceptible. Of the summer varieties, Heil's Franken and Heine's Goldthorpe were resistant and Pflug's 'Intensiv' was highly susceptible; other susceptible varieties were Streng's Franken, Eglfinger Hado, Pflug's 'Extensiv', Ackermann's Bavaria and Danubia, and Heine's and Mittlauer Friedrich's Hanna.

The infection percentages hitherto obtained are not really adequate for disinfection and varietal reaction tests. This may be partly attributable to the relatively low incidence of stripe disease under natural conditions, but it would seem that the present inoculation methods still leave room for improvement.

SMITH (N. J. G.) & PUTTERILL (K. M.). **Pycnidia produced by Helminthosporium parasites of cereals and wild grasses.**—*S. African Journ. of Sci.*, xxix, pp. 286–295, 5 figs., 1932.

The production of pycnidia in culture by *Helminthosporium teres*, *H. gramineum*, and *H. avenae* [*R.A.M.*, x, p. 373, and next abstract], collected in various parts of England and Scotland, has

been observed by the senior author between 1922 and 1932. One South African isolation of *H. teres* from Grahamstown, Cape Colony, has also formed pycnidia. Among the media stimulating pycnidial formation were potato agar, Brown's synthetic (asparagin) [ibid., vii, p. 475], and barley leaf decoction agar. Neither temperature nor light appears to be of paramount importance in the process. Pycnidia were extensively formed in cultures contaminated by other fungi or bacteria.

At Cambridge, pycnidia of *H. teres* were found in fair numbers on old barley straw, while the chaff of a dry oat grain has been observed to bear a pycnidium of *H. avenae.* In South Africa fairly old leaves of *Cynodon dactylon* infected by a *Helminthosporium* bear abundant piriform pycnidia up to 75 $\mu$ in diameter (110 $\mu$ in culture), the development of which is described in some detail. In the central cavity one or more layers of active cells give off fine unbranched, deeply staining hyphae, which fill the cavity and converge towards the neck of the fruit body. These hyphae then become separated from the collapsed cells from which they arise, and transverse constrictions eventually break them up each into several hyaline pycnospores, 5 to 6 by 3 $\mu$ in diameter. Germination has not been observed. The dark brown, 3- to 5-septate *Helminthosporium* conidia of this fungus, which are produced together with the pycnidia, measure on an average about 20 by 8 $\mu$, though they may attain 42 $\mu$ in length and nearly 16 $\mu$ in width. In culture they are borne in very large clusters on dark conidiophores, and they germinate in a bipolar fashion. On the host this fungus causes dark brown lesions of indefinite outline on the leaves and sheaths. It differs from *H. cynodontis*, which is common at Grahamstown and has more hyaline conidia, about twice as long as those of the pycnidium-forming species; in fact, some of the conidia in the writer's cultures are longer than the largest cited by Drechsler [ibid., iii, p. 65].

The pycnidia of *H. teres* observed by the writers were usually smaller than those previously described by Ravn and their pycnospores are budded off from the ends of short, deeply staining hyphae which arise as radially directed prolongations of irregularly arranged, rounded cells bounding the cavity of the pycnidium. *H. gramineum* and *H. avenae* appear to have pycnidia resembling those of *H. teres.*

O'BRIEN (D. G.) & DENNIS (R. W. G.). **Further experiments on leaf stripe of Oats.**—*Scottish Journ. of Agric.*, xv, 4, pp. 406–410, 1 pl., 1 fig., 1932.

Further investigations have been conducted at the West of Scotland Agricultural College on the etiology and control of leaf stripe of oats (*Helminthosporium avenae*) [*R.A.M.*, xi, p. 295].

In an experiment carried out in March, 1932, no leaf stripe developed in plots from seed treated with ceresan, whereas 22·8 per cent. occurred on a control section. It has been estimated by seedling counts that four bushels per acre of treated seed-grain give a yield equivalent to that from five bushels untreated. In a test with the highly susceptible Yielder variety, the treated section gave 218 seedlings per unit area, compared with 170 on the

untreated. Treatment thus imposes a reduction of 20 to 25 per cent. in the sowing rate.

The mycelium of *H. avenae* is invariably present on seed harvested from an infected crop. It is situated mainly at the tip of the inner and outer palea, whence the infection of the emerging shoot takes place. As the coleoptile grows out between the tips of the paleae, it comes into contact with this mycelium and becomes infected at the two points of contact with the paleae. As successive regions of the coleoptile pass the infective points, two narrow, brown, longitudinal lesions are formed on each side.

The fungus was found to develop freely only on sterilized soil and to be quite unable to compete with the normal saprophytic fungi of the field. Portions of an active culture of *H. avenae* were placed in the soil at a little distance from healthy oat seed-grain under controlled conditions favouring leaf stripe development, but no trace of disease occurred in the seedlings. The resting mycelium and sclerotia of the fungus may be found in profusion on stubble left from an infected crop, and are capable of overwintering in the open as easily as on harvested grain. When such stubble is ploughed in, therefore, it affords a ready source of infection for the new crop if sown on the same land and if the seed comes into direct contact with the fungus.

Even the complete elimination of primary infection by seed treatment does not necessarily confer protection from the secondary phase of conidial dissemination, as shown by a test in 1931 in which all the plants of an originally clean, ceresan-treated plot developed leaf stripe in the late summer. Annual seed treatment with an effective fungicide must, therefore, be given.

The results of seed-grain treatment were not so striking in 1931, when the harvesting period was relatively fine, as in the wet season of 1930.

The examination of seed samples from various localities in the north, midlands, and south of England showed that leaf stripe is widespread in Great Britain, the amount of infection in this material ranging from 4 to 72 per cent. according to the variety and place of origin. Individual strains of the fungus have shown the marked morphological and physiological variations in culture typical of the genus.

ALLEN (RUTH F.). **A cytological study of heterothallism in Puccinia coronata.**—*Journ. Agric. Res.*, xlv, 9, pp. 513–541, 16 pl., 1932.

This is a detailed and fully illustrated account of the author's study of heterothallism in *Puccinia coronata* [*P. lolii*] a preliminary paper on certain parts of which has already been noticed [*R.A.M.*, x, p. 235]. As the spermogonia develop, hyphae from them, or from the vegetative mycelium, or from young aecidia grow out to the surface through the stomata or between the epidermal cells. These serve to receive the nuclei from spermatia of opposite sex. From their tips the sporophytic generation arises by growth of diploid hyphae and probably also by nuclear divisions and migrations through the existing haploid hyphae. The

aecidium may begin as a haploid body or may be formed of both haploid and diploid hyphae from the start. Occasional cell fusions are found in it, sometimes between uninucleate cells, sometimes between cells, one or both of which contain more than one nucleus. The basal cells from which the spore chains arise are predominantly binucleate, the spores always so.

Blattný (C.). **Zur Diskoloration der Haferblätter infolge Magnesiummangels.** [On the discoloration of Oat leaves in consequence of magnesium deficiency.]—*Zeitschr. für Pflanzenernährung, Düngung und Bodenkunde*, A, xxvi, 3–4, pp. 216–218, 1 fig., 1932.

Oat plants growing in sandy soil (formerly a vineyard) in Czecho-Slovakia showed a longitudinal mottling of the leaves running parallel with the veins, accompanied by an inward rolling of the tips. The affected leaf areas, which were sharply differentiated from the normal tissue, ranged from pale green in the youngest (heart) leaves to white in the dead ones.

When some plants were removed from this site to soil with a fairly high magnesium content, they rapidly lost the symptoms of mottling and acquired a rich green tint. A further series replanted in the original vineyard soil but receiving a top-dressing of magnesium sulphate (0·06 gm. per plant) regained a normal green coloration in three weeks. A close connexion is thus demonstrated between magnesium deficiency and longitudinal mottling of oat leaves [cf. *R.A.M.*, xi, p. 101].

Borghardt (A. I.). **Современное состояние вопросов в области познания болезней Кукурузы.** [The present state of our knowledge of the diseases of Maize.]—*Scient. Res. Inst. for Maize and Sorghum Cultivation*, Dniepropetrovsk, *Publ.* 28, 53 pp., 9 figs., 1932.

This is a brief but comprehensive compilation from the literature [largely American] on the chief diseases that attack maize throughout the world. By far the greatest space is given to the two smuts *Ustilago zeae* [*R.A.M.*, xi, p. 569] and *Sorosporium reilianum* [ibid., x, p. 590], which are stated to cause the most damage to the crop in Soviet Russia. *Sclerospora graminicola* [ibid., xi, p. 634] is endemic in South Russia on the weed *Setaria viridis*, and in wet years does considerable damage to Italian millet [*S. italica*], and should be carefully watched, as its potentialities as a parasite to maize are still obscure. The crop is also subject to attacks by bacteria, among which *Bacillus zeae* Burrill, *Aplanobacter stewarti* [ibid., xii, p. 78], and *Bacterium holci* [ibid., xi, p. 364] have definitely been recorded in Russia.

A bibliography comprising 159 titles is appended.

Smith (F. E. V.). **Citrus scab.**—*Journ. Jamaica Agric. Soc.*, xxxvi, 10, pp. 500–502, 1932.

While sour orange [*Citrus aurantium* var. *bigaradia*], Temple [hybrid] and King [*C. nobilis*] oranges, and lemon are susceptible

to scab [*Sporotrichum citri*: *R.A.M.*, xii, p. 21 and next abstract] in Jamaica, sweet orange [*C. sinensis*], grapefruit and shaddock [*C. decumana*], and almost all other kinds of citrus are highly resistant. In some nurseries of sour oranges intended as stocks, however, the effects of the disease are extremely serious, retarding the budding of the seedlings for twelve or eighteen months.

Scab being most severe in conditions of high humidity, it is essential that nurseries should be well drained and weeded, and remote from any old sour orange or lemon trees. A close and constant watch must be kept for the initial infection of the young shoots, as the evidence indicates that scab may be seed-borne. If the disease appears, all the diseased shoots should be cut off and burned at frequent intervals, this being followed at intervals of two to four weeks (according to the prevailing weather and the amount of new growth) by applications of Bordeaux mixture (4–4–40) or Burgundy mixture (4–5–40), preferably with the addition of about 1 per cent. miscible oil. If young growth is being made profusely the strength of the mixtures should be reduced by one quarter.

If the disease does not appear until the seedlings are almost ready for budding, it is often unnecessary to spray, as the scions are usually of resistant species of citrus and the disease is automatically controlled after the bud takes.

In conclusion emphasis is laid upon the necessity for choosing fresh land for every new nursery.

HENRICKSEN (H. C.). **Introductory notes to a study of Citrus scab. A study of Citrus scab. Some chemical differences in leaf tissue with reference to susceptibility to scab.**—*Agric. Notes, Porto Rico Agric. Exper. Stat., Mayaguez*, 62, 63, 7 pp., 1932. [Mimeographed.]

The following three possible methods of combating citrus scab [*Sporotrichum citri*: *R.A.M.*, x, p. 777 and preceding abstract] in Porto Rico are suggested: spraying or dusting with copper or sulphur, injection of chemicals into the trees, and the application of a potash fertilizer. Both spraying and dusting are open to various objections and give erratic results in the field; the technique of injection is not yet sufficiently developed to admit of a conclusion as to its practical value, while studies have been planned to determine the utility of potash in this connexion.

An investigation was made of the moisture, wax, oil, acid, plastid pigment, soluble carbohydrate and protein, and glucoside contents of old and young citrus leaf tissues with a view to ascertaining the reason of their relative susceptibility to scab. The wax, oil, and pigment contents were found to be higher in the old than in the young tissues, while moisture, carbohydrates, and proteins were more plentiful in the latter. A correlation between these data and scab infection is indicated.

LESTER-SMITH (W. C.). **Citrus mildew.**—*Phytopath.*, xxii, 10, p. 870, 1932.

In *Phytopath.*, ix, p. 266, [1919], a correction is made by T. Petch on a previous note (ibid., v, p. 350, [1915]), in which he states that

citrus mildew (*Oidium tingitaninum*) [*R.A.M.*, x, pp. 80, 786] does not occur in Ceylon on pomelo (*Citrus decumana*). A recent revision of the citrus species attacked by this mildew, however, shows that it occurs commonly in Ceylon on pomelo and grapefruit, as well as on sweet, mandarin, and sour oranges, lemons, and kalamondin orange (*C. mitis*). No perithecial stage of the fungus has yet been observed. Good control of the mildew may be obtained by weekly applications of certain lime-sulphur mixtures during warm, damp weather.

GREEN (F. MARY). **The infection of Oranges by Penicillium.**—*Journ. Pomol. and Hort. Science*, x, 3, pp. 184–215, 6 figs., 1932.

This is a detailed account of the author's investigation under controlled conditions of the mechanism of infection of orange fruits with blue and green moulds (*Penicillium italicum* and *P. digitatum*, respectively) [*R.A.M.*, xi, p. 366]. The inoculum used throughout the work was obtained from an original South African orange attacked by both fungi. Infection of oranges inoculated with a water suspension of the spores of either species through needle punctures of the surface succeeded only when the stabs went beyond the outer yellow rind or flavedo (which is a hard, compact tissue, containing no soluble pectin), and entered the inner white rind or albedo (a soft tissue, containing considerable quantities of soluble pectin). The depth of puncture necessary to obtain 100 per cent. infection appeared to be correlated with the degree of ripeness and the variety of the oranges. The addition of orange juice, rind extract, acids, or ammonium oxalate to the suspension promoted infection even through minute, shallow wounds in the outer rind alone. Superficially sound fruits could be infected without wounding only after the resistance of the outer rind was broken down by treatment with an acid or ammonium oxalate (which hydrolysed the insoluble pectic substances of the cell walls into soluble pectin), or by direct application to the surface of infective juice and rind from a recently rotted orange. Experiments showed that the resistance of the uninjured rind was not due to the presence of any growth-inhibiting substance and that its breaking down by acids was due to the action of the acid on the rind and not on the fungus.

These results are interpreted to indicate that the two species of *Penicillium*, when growing in orange juice and rind (but not in synthetic media), produce a system which destroys the resistance, considered to be mechanical in nature, of the outer rind of healthy fruit. The action of this system, while similar to that of acids in that it causes hydrolysis of the pectic substances of the cell walls, goes still further and brings about the dissolution of the walls, thus affording free entry to the fungi. Hydrogen-ion concentration was shown to be one factor in the resistance-destroying system produced by the organisms in a mouldy orange, since both this concentration and the infective power of mouldy rind decreased parallel with increasing age of the infected oranges. It is believed, however, that there is also another factor concerned, possibly enzymic in nature, which has not yet been determined.

GIOELLI (F.). **Fenomeni di antagonismo in 'Penicillium digitatum' (Pers.) Sacc. e 'Penicillium italicum' Weber in natura. (Nota preliminare).** [Phenomena of antagonism in *Penicillium digitatum* (Pers.) Sacc. and *Penicillium italicum* Weber in nature. (A preliminary note.)]—*Riv. Pat. Veg.*, xxii, 7–8, pp. 195–200, 3 figs., 1932.

While examining diseased oranges, lemons, and mandarins the author frequently observed fruits attacked both by *Penicillium digitatum* and *P. italicum* [see preceding abstract], the fungi showing evident signs of mutual antagonism. On lemons, especially, *P. digitatum* had often invaded the whole fruit and surrounded a small patch of *P. italicum.* When two wounds were made on lemons, one being inoculated with *P. italicum* and the other with *P. digitatum*, the latter quickly demonstrated its dominance; on many of the fruits a broad line of demarcation developed, but on others the mutual antagonism of the fungi set up morphological modifications, such as a copious aerial mycelium round the infected area.

BALLY (W.). **Geographische Verbreitung der Krankheiten des Kaffeebaumes.** [The geographical distribution of the diseases of the Coffee tree.]—*Verh. Schweiz. Naturforsch. Gesellsch.*, cxiii, p. 367, 1932.

Notes are given on the geographical distribution of a number of coffee diseases.

KADEN (O. F.). **Observations concerning the healthiness of Coffee trees in Costa Rica.**—*Trop. Agriculture*, ix, 11, pp. 350–351, 1932.

In noting the excellent general health of coffee plantations in Costa Rica, the author states that the only fungal diseases which were in evidence during his visit there in May [? 1932] were *Omphalia flavida* [*R.A.M.*, xi, pp. 283, 431], *Cercospora coffeicola* [ibid., xi, p. 283], and a species of *Rosellinia*, needing careful watching, which causes a kind of collar crack. In his opinion, *O. flavida* is not as dangerous as generally described in literature, in no way comparable with *Hemileia vastatrix* in the East; it chiefly occurs in places that are too damp, or on trees that are overcrowded and badly pruned; its prevention and control should present little difficulty.

The author also noticed in Costa Rica, particularly in the oldest cultivated districts, a non-parasitic disease of coffee, similar to one which he had observed the previous year in Angola (Portuguese West Africa); it is characterized by a drying of the branches, shedding of the leaves, and occasionally the death of the whole bush. Preliminary observations indicate that the trouble is brought about by some deficient environmental factor or factors, and is also favoured by unsuitable pruning. The affected bushes appear to suffer from some interference with their nutrition at the critical period of their growth during the dry season. The paper terminates with a brief discussion of the measures for the control of the disease.

Gyde (L. M.). **Some observations on the genus Hemileia.**—*S. African Journ. of Sci.*, xxix, pp. 296–300, 6 figs., 1932.

*Hemileia* occurs in many of the warmer parts of South Africa as a parasite of various Rubiaceous plants, including *Gardenia*, *Vangueria pygmaea*, and *V. infausta* [cf. *R.A.M.*, iv, p. 165; vi, p. 258; xi, p. 636], producing pale yellow to orange, later dark brown patches on the leaves, which wither and fall in severe cases.

Marked differences in the incidence of *H. vastatrix* were shown by a recent inspection of the plantations of two coffee growers in the Tzaneen district, one of which was entirely free from the rust, while about 40 per cent. of the foliage was attacked in the other. The healthy plantation is situated at an altitude of some 3,000 ft., the soil being clean of weeds, and cattle dung used for manuring; the infected garden is 1,000 ft. nearer sea level and was green-manured by digging in the abundant weeds. In both plantations papaw trees were used for shade.

Cross-inoculation experiments [the technique of which is indicated] were made with *Hemileia* between various Rubiaceae. On coffee the incubation period was about 30 days when the average maximum temperature was 85·9° and the average minimum 66·7° F. Apart from one doubtful case of transference from *Gardenia* to coffee, the only other successful cross-inoculations were from *V. pygmaea* to *V. infausta*. These results agree with those obtained by Pole Evans (*Ann. Rept. Transvaal Dept. Agric.*, p. 165, 1906–7), and fail to support Massee's contention that the establishment of coffee plantations in the vicinity of *Vangueria* would probably be disastrous.

The average dimensions of the uredospores on coffee were 35 by 25 $\mu$, the corresponding figures for *V. infausta* and *V. pygmaea* being 32 by 23 and 27 by 15 $\mu$, respectively. The time required for germination was six days for uredospores from coffee and three and seven, respectively, for those from *V. infausta* and *V. pygmaea*. The uredospores from *V. pygmaea* germinated in water and in 0·5 per cent. cane sugar. No germination occurred in a 2 per cent. lactic acid solution or in one of equal parts of 2 per cent. lactic acid and 0·5 per cent. cane sugar. A few teleutospores developed in the uredosori on *V. pygmaea*; one measured 17 by 15 $\mu$ as compared with 27·5 by 15 $\mu$ for a neighbouring uredospore. Inoculation of *V. pygmaea* with uredospores from *V. infausta* resulted in the production of sori with smaller uredospores than those on *V. infausta* but larger than those normally found on *V. pygmaea*.

Palm (B. T.). **Eriodendron as host of Bacterium malvacearum.**—*Phytopath.*, xxii, 10, pp. 867–868, 1932.

The well-known Mexican variety 'Pochote' of the kapok tree (*Eriodendron anfractuosum*) on the Pacific coast of Guatemala is stated to be subject to a fairly serious bacterial disease caused by *Bacterium malvacearum*, this being apparently the first record of the cotton parasite outside the genus *Gossypium* [but cf. *R.A.M.*, iii, p. 272].

The disease is most prevalent in seed-beds during the rainy season and affects both leaves and stems. The former show the

most conspicuous symptom, consisting of irregular spots surrounded by an oily, translucent halo. As the mesophyll is invaded it shrivels and turns dark brown. If the spots occur near the points of the digitate leaves little damage results, but if the base of the leaflets is infected defoliation soon follows. Infection is readily transmitted through the bud scales to the developing leaf, so that premature shedding ensues. Full grown leaves are infected almost exclusively on the upper surface, and the spread of the organism is so slow that a protective tissue can be generated in the mesophyll, thereby preventing the pathogen from penetrating through the thickness of the leaf. The petioles are also liable to infection from which defoliation invariably results.

On the infected stems of young plants oblong, brown lesions develop rapidly. The centres of the spots turn greyish with age, and the border zone may appear slightly raised owing to the extensive formation of wound cork. The lesions may remain superficial and cause little damage, but in wet weather, when the stem makes rapid growth, the xylem may be penetrated near the growing point, which is killed by the formation of a girdle of necrotic tissue round the main axis. One or more new shoots may then be repeatedly formed below the girdle, with the result that the entire habit of the tree is changed during the growing season to a stunted, irregular type of branching that renders it useless for planting. In infected horizontal branches of older trees, the new shoots formed below the growing point grow upwards at a right angle to the supporting branch.

Cross-inoculation experiments showed that *Bact. malvacearum* from cotton readily produced lesions of the above-mentioned type on *E. anfractuosum*, and vice versa.

MOORE (M.). **Coccidioidal granuloma: a classification of the causative agent, Coccidioides immitis.**—*Ann. Missouri Bot. Gard.*, xix, 4, pp. 397–427, 1 pl., 1932.

The history, geographical distribution, and symptoms of coccidioidal granuloma are described, with a summary of the pathological conditions associated with the disease. Regarded at first as a protozoon under the name *Coccidioides*, the organism was subsequently referred to the fungi and assigned to the genera *Oidium*, *Mycoderma*, *Podadasia*, *Blastomycoides* [*R.A.M.*, x, p. 104, and next abstract] by various workers. The author grew the causal organism from the spores liberated from the spherical bodies found in the tissues, and obtained a well-developed mycelium of septate cells irregular in size and shape and up to 4 $\mu$ broad. Arthrospore-like segments, up to 11 $\mu$ in diameter, are cut off and enlarge into spherical bodies, the asci, in which very numerous minute spores develop. These are liberated by a thinning of the wall and germinate by elongating into a germ-tube from which the septate mycelium develops.

After a full discussion of the systematic position of the fungus, the writer refers it to the Endomycetales, in which he establishes a new family, Coccidioideaceae, with *Coccidioides* as the chief genus represented by two species, *C. immitis* and *C. esferiformis* (syn. *C. brasiliensis*).

Agostini (Angela). **Observations on fungi found in cases of North American blastomycosis of the skin and lungs.**—*Journ. Trop. Med. & Hygiene*, xxxv, 17, pp. 266–268, 2 figs., 1932.

The writer's studies of Prof. Castellani's cultures of *Blastomycoides* [*R.A.M.*, viii, p. 103], of which that on *B. lanuginosus* has already been completed [determined as *Glenospora lanuginosa*: ibid., xi, p. 106], have been extended to *B. immitis* [see preceding and next abstracts] and *B. tulanensis*, isolated from North American cases of blastomycosis of the skin and lungs. These fungi are renamed *Geotrichum immite* (Rixford & Gilchrist) Agostini and *Monosporium tulanense* (Castellani) Agostini, respectively, revised Latin diagnoses being given. *G. immite* forms white, pulverulent, flocculent colonies, later turning yellow, on agar. The hyphae measure 2 to 2·5 $\mu$ in diameter (later 3 to 5 $\mu$) and are often joined in bundles; cylindrical arthroconidia are formed, 6 to 9 $\mu$ in length. There is also a racquet-shaped mycelium and irregular arthrospores, while large, cystiform chlamydospores, 8 to 15 $\mu$ in diameter, may also be observed. The optimum temperature for growth is 22° to 27° C., but development also takes place at 10° to 20°. Gelatine and serum are rapidly liquefied, glucose and maltose not fermented, and milk not coagulated.

*M. tulanense* also forms both slender (1 to 2 $\mu$) and thicker (4 to 5 $\mu$) hyphae, which are continuous or septate and branched; the oblong, piriform, or roundish conidia measure 5 to 7 by 3 to 5 $\mu$, and round chlamydospores, 8 to 15 $\mu$ in diameter, also occur, sometimes in chains. The fungus grows at a temperature range of 10° to 27° (optimum 20° to 25°). Milk is not coagulated, nor serum nor gelatine liquefied.

Ciferri (R.). **Sulla posizione sistematica del genere Coccidioides e di due generi affini.** [On the systematic position of the genus *Coccidioides* and of two related genera.]—*Arch. für Protistenkunde*, lxxviii, 2, pp. 238–262, 2 figs., 1932. [German summary.]

The life-history of *Coccidioides immitis* [see preceding abstracts] can be divided into two parts, namely, the saprophytic phase (hyphae-resting spores and resting spores-hyphae), and the parasitic (zoosporangia-zoospores and zoospores-zoosporangia). Under parasitic conditions the resting spores are transformed into zoosporangia, while in the saprophytic state the zoospores produce hyphae. As regards its systematic position the organism belongs to the Chytridineae [ibid., xi, p. 515], the genus *Coccidioides* being the sole representative of the new family Coccidiaceae which differs considerably from the Protomycetaceae.

The genus *Dermocystidium*, comprising *D. pusula* on *Triton marmoratus* and *D. branchialis* on *Trutta fario*, is referred to the Olpidiaceae, while the related genus *Rhinosporidium* (*R. seeberi*) [ibid., xi, p. 641] is placed in a special family, the Rhinosporidiaceae.

A bibliography of nearly fifty titles is appended.

Bennett (S. C. J.). **Epizootic lymphangitis: mycelial forms of the parasite in a natural case.**—*Journ. Compar. Path. & Therapeutics*, xlv, 2, pp. 158–160, 3 figs., 1932.

A brief account is given of the occurrence of mycelial forms of *Cryptococcus farcinimosus* [*R.A.M.*, xi, p. 641] in a spontaneous case of epizootic lymphangitis in a horse in the Sudan. This is believed to be the first record of the mycelial stage of the fungus in living tissues as opposed to artificial cultures.

[In an editorial footnote it is stated that short hyphae in pus from lesions were described by Tokishige in Japan.]

Keating (P. M.). **Fungus infection of bone and joint.**—*Southern Med. Journ.*, xxv, 10, pp. 1072–1078, 1932.

A species of *Monilia* [*Candida*], probably *albicans* [*R.A.M.*, xi, p. 373], was isolated from a number of cases of bone and joint diseases in Texas, including chronic polyarthritis, osteitis of the vertebral bodies, sacrum, and ilium, osteochondritis, and Paget's disease. Iodide therapy gave beneficial results in the majority of cases. Inoculation experiments on guinea-pigs were positive. The paper is followed by a discussion.

Manson-Bahr (P.). **Trichosporon beigeli parasitic on human hair from Nigeria.**—*Trans. Roy. Soc. Trop. Med. & Hyg.*, xxvi, 1, p. 9, 1932.

*Trichosporon* [*Trichosporum*] *beigeli* [*R.A.M.*, v, p. 363] was isolated from the pubic hairs of a patient at Sokotu, northern Nigeria. The fungus produces on the hairs irregular nodosities containing fungal elements, 3 to 5 $\mu$ in length. In culture a mycelium develops bearing arthrospores giving rise to blastospores, and in older cultures to ascospores [cf. ibid., vii, p. 783; viii, p. 241: ix, p. 35]. *T. beigeli* is stated to have been first discovered in London by Beigel in 1862, and is of occasional occurrence in Europe, though much more common in Central Africa and Japan. The beard and moustache may also be involved.

Baudet (E. A. R. F.). **Recherches expérimentales sur les Trichophyton animaux à cultures faviformes.** [Experimental studies on species of *Trichophyton* with faviform cultures, isolated from animals.]—*Ann. de Parasitol. Humaine et Comp.*, x, 6, pp. 520–541, 7 pl., 3 figs., 1932.

In the experiments described in this paper the author used five megasporous strains of *Trichophyton*, three of which were isolated from cows, one from a horse, and one from a goat. When grown on glucose agar, these strains produced typical faviform cultures, but occasionally subcultures on the same medium, especially at 25° C., developed a slight, short down which disappeared at the slightest contact with a platinum wire. When grown, however, on an agar medium prepared with a killed culture in bacteriological broth of a species of *Staphylococcus* of human origin [cf. *R.A.M.*, xi, p. 516], the *Trichophyton* strains produced a well-defined aerial sporiferous apparatus with aleuriae, a similar growth being also produced on potato and carrot, and on oleic acid agar. In the author's opinion these observations indicate that the term

'faviform' will have eventually to disappear from the nomenclature of species of *Trichophyton* originating from animals, since he considers that the glabrous character of the cultures is only due to the growth of these fungi on media unfavourable for their development.

PUNTONI (V.) & PAMPANA (E. J.). **A copper-coloured variety of caraate caused by Trichophyton megnini (Tr. rosaceum.)**—*Journ. Trop. Med. & Hygiene*, xxxv, 10, pp. 154–156, 1932.

After a brief review of the previous literature relating to the desquamating dermatomycosis known as 'caraate' or 'carate' ('pinta') in South America, the writers report a case of this disorder with predominantly brownish-coppery spots in a negro in Colombia.

The fungus isolated from the majority of the lesions was characterized by a branched mycelium, often with terminal or lateral aleuria, arranged in simple bunches at the ends of the hyphae. On Sabouraud's medium the colonies were velvety-white at first, later turning pink on the surface and dark violet at the back, with radial folds. A pleomorphic variant of the organism developed snow-white, velvety, plurisulcated colonies with a faint pink pigmentation at the back, later turning blackish and assuming an irregular shape. The fungus was identified as *Trichophyton megnini* (*T. rosaceum*) [*R.A.M.*, xi, p. 783].

Species of *Penicillium* and *Aspergillus* were sometimes associated with *T. rosaceum* in the lesions, but their etiological role is doubtful.

LOURIER (A. G.) & REIFF (M. G.). **Un cas de favus généralisé de la peau avec présence d'"Achorion schoenleini" dans les cultures du sang et du suc des glandes lymphatiques.** [A case of generalized favus of the skin with the presence of *Achorion schoenleini* in cultures of the blood and fluid of the lymphatic glands.]—*Ann. de Dermatol.*, Sér. VII, iii, 10, pp. 912–916, 2 figs., 1932.

Since the war there has been a steady increase in the incidence of dermatomycoses in Russia as in other parts of Europe, and some of these disorders formerly regarded as rarities are now of common occurrence. A note is here presented on the development in a 14-year-old girl of generalized favus of the scalp and body due to *Achorion schoenleini*, which was obtained in pure culture not only from the skin, hair, and nails, but also from the blood and the fluid of the submaxillary glands.

TOWEY (J. W.), SWEANY (H. C.), & HURON (W. H.). **Severe bronchial asthma apparently due to fungous spores found in Maple bark.**—*Journ. Amer. Med. Assoc.*, xcix, 6, pp. 453–459, 7 figs., 1932.

Details are given of a clinical, roentgen, and laboratory study carried out on a series of 35 patients in the Upper Peninsula of Michigan showing typically asthmatic symptoms, including dyspnoea, cough, loss of weight, and fever. It was found on investigation that the men were working in railway and motor plants where they came into contact with dust from maple [*Acer*

sp.] logs cut for over a year. The dust was found on analysis to contain the spores of a fungus identified at the Wisconsin Forest Products Laboratory as *Coniosporium corticale*, which is reported to have occurred recently on dying maples, hickories [*Hicoria* spp.], and basswoods [*Tilia* spp.] in Wisconsin. Extracts of the spores produced local skin reactions in the affected group, as also did a suspension of macerated spores, while control tests gave negative results. The condition under discussion is tentatively attributed to a local toxic effect and foreign body reaction combined with a delayed effect resembling protein sensitization in its clinical and certain immunological aspects. The spores of *C. corticale* caused a sensitization, following parenteral administration to guinea-pigs, which was pathologically related to anaphylaxis. The first definite spore asthma in human beings is stated to have been reported by F. T. Cadham, of the University of Manitoba (*Journ. Amer. Med. Assoc.*, lxxxiii, 5th July, 1924), who investigated the condition in three harvest hands sensitized by the wheat rust (*Puccinia graminis*).

CIFERRI (R.). **Cephalosporium pseudofermentum n. sp. isolato dalla bocca dell'uomo.** [*Cephalosporium pseudofermentum* n. sp. isolated from the mouth of man.]—*Arch. für Protistenkunde*, lxxviii, 2, pp. 227–237, 1 pl., 2 figs., 1932. [German summary.]

*Cephalosporium pseudofermentum* n. sp. was isolated in 1929 from the mouth of a white student on the island of Moca, Antilles, suffering from an obscure gastro-enteric malady of the 'sprue' type. The fungus [a Latin diagnosis of which is given, together with an amended description of the genus and taxonomic notes] forms pale, later pink colonies on agar, with a hyaline, densely branched, septate mycelium, 1·5 to 2·5 $\mu$ in diameter; intercalary or more rarely apical, single or 3- to 4-catenulate, cylindrical or spherical chlamydospores, budding profusely, the single cells measuring 3 to 7 by 2·5 to 4, average 3·6 by 3 to 3·5 $\mu$; and cylindrical, elliptical, ovoid or reniform conidia with rounded or acuminate apices, 3 to 5 by 1·5 to 2·5 $\mu$, borne in clusters of 20 to 50, or more rarely up to 100 or more, in heads 5 to 45 $\mu$ (mostly 10 to 20 $\mu$) in diameter, at the apex of more or less distinct conidiophores.

TILFORD (P. E.). **Diseases of ornamental plants.**—*Ohio Agric. Exper. Stat. Bull.* 511, 82 pp., 34 figs., 1932.

Popular notes are given on the symptoms, etiology, and control of the fungous, bacterial, and physiological diseases affecting ornamental plants in Ohio.

SIRAG-EL-DIN (A.). **Simple cures for Rose diseases.**—*Min. of Agric. Egypt Mycol. Res. Div.* (*Plant Protect. Sect.*) *Leaflet* 18, 4 pp., 2 col. pl., 2 figs., 1932.

Popular notes are given on the symptoms, etiology, and control of rose mildew and rust (*Sphaerotheca pannosa* and *Phragmidium mucronatum*) [*R.A.M.*, xi, p. 694], respectively, in Egypt. Against the former disease two applications of a 1·5 per cent. soda and

soap solution (15 gm. soda, 5 gm. soap, and 1 l. water) are recommended for use when there are no leaves on the bushes (early in February and early in September) or 0·75 per cent. (half the above quantity of soda) at other times; while rust may be controlled by spraying with 1 per cent. copper sulphate when there are no leaves on the bushes, in addition to destroying all diseased leaves.

GOETZ (O.) & WINKELMANN (A.). **Der Schwefelvernebelungsapparat 'Sulfurator.'** [The sulphur vaporization apparatus 'Sulfurator'.]—*Blumen- und Pflanzenbau*, xlvii, 10, pp. 152–153, 1 fig., 1932.

Further details are given of the construction and use of the Sulfurator sulphur vaporization apparatus [*R.A.M.*, xi, p. 254; xii, p. 62], especially against the mildews of roses [*Sphaerotheca pannosa*] and other plants [see preceding and next abstracts]. In addition to the large and small types already described, a medium-sized apparatus is now available, holding 1,500 gm. sulphur and weighing 18 kg. In experiments with the large apparatus greenhouses of 25,000 cu. m. were treated in 2 to $2\frac{1}{2}$ hours, 6 kg. sulphur sufficing for 10,000 cu. m.

HAHMANN (C.). **Schwefelnebel im Gewachshaus.** [Sulphur mist in the greenhouse.]—*Blumen- und Pflanzenbau*, xlvii, 10, p. 151, 1932.

Excellent control of hydrangea mildew (*Oidium hortensiae*) [*R.A.M.*, x, p. 32] is stated to have been obtained in a greenhouse of 1,600 cu. m. at Berne, Switzerland, by the use of Rupprecht's Sulfurator sulphur vaporization apparatus [see preceding abstract]. The apparatus filled the greenhouse with a thick mist in about ten minutes, and after two hours a thin layer of sulphur could be detected all over the plants, as well as on the ground and elsewhere.

WAGER (V. A.). **Aster wilt in South Africa.**—*S. African Journ. of Sci.*, xxix, pp. 301–312, 1932.

Aster (*Callistephus chinensis*) wilt is stated to be spreading to an alarming extent in South Africa. In Pretoria, for instance, these flowers can no longer be grown in a large number of gardens. The typical symptoms of the disease appear when the plants are a foot or more in height, when they wilt suddenly, the leaves turning first yellow and then brown and curling up, while the stem and branches remain erect. A black streak usually appears on one side of the stem, sometimes extending from soil level to the tip. *Fusarium conglutinans* var. *majus* (determined by Wollenweber) was isolated both from the interior of diseased stems and from the pink spore masses developing on the surface, and inoculation experiments showed it to be a virulent pathogen of asters. This is apparently the first record of the pathogenicity of this variety, aster wilt in other countries being due to *F. conglutinans* var. *callistephi* [*R.A.M.*, xii, p. 79], which was not encountered by the writer.

*Sclerotium rolfsii*, *Rhizoctonia* [*Corticium*] *solani*, and *Pythium ultimum* [ibid., xi, pp. 331, 408] were also isolated from young

wilting asters, and the two latter were shown by inoculation tests to be capable of killing the plants. Probably they would only be dangerous, however, in the early stages of growth. *S. rolfsii* was unable to induce wilt artificially. *F. conglutinans* var. *majus* was not found attacking any other plant. It grew best at a temperature of about 80° F.

Asters were grown for inoculation in soils of varying hydrogen-ion concentrations, and wilt was found to develop progressively as the acidity increased, whereas on the alkaline side of neutrality wilting decreased. The incidence of the disease, however, was not appreciably influenced by the application of agricultural lime up to 10,000 lb. per acre on soil with an initial $P_H$ of 7·1, nor was infection arrested by soil treatments with uspulun, copper sulphate, mercuric chloride, Cheshunt compound, or potassium permanganate.

A number of aster varieties that have proved resistant to *F. conglutinans* var. *callistephi* were grown in heavily infected soil in Pretoria and developed an average of 47 per cent. wilt, compared with 100 per cent. in the local variety used as a control. The use of such semi-resistant varieties appears to offer the best hope of control.

TASUGI (H.) & KUMAZAWA (M.). **Phytophthora blight of Peony. (Studies on Japanese Peronosporales, I.)**—*Journ. Imper. Agric. Exper. Stat.*, Nisigahara, Tokyo, ii, 1, pp. 75–96, 3 pl., 3 graphs, 1932. [Japanese, with English summary.]

Peony (*Paeonia albiflora*) plants at the Nisigahara Agricultural Experiment Station were observed, in May, 1929, to be suffering from a leaf, stem, and bud blight, the affected parts being greyish-brown or black and somewhat leathery. The diseased tissue was found to contain an intercellular mycelium sending small, spherical haustoria into the host cells.

A species of *Phytophthora* was constantly isolated from the infected material, characterized by ovoid, hyaline sporangia with broad apical papillae, borne in groups of 1 to 13 (usually 3 to 5) on the sporangiophores and measuring 18·2 to 36·4 by 14·5 to 29·1 $\mu$ (average 26·3 by 21·9 $\mu$), papilla 3·6 to 7·3 by 1·8 to 7·3 $\mu$ (4·9 by 3·3 $\mu$). The zoospores are 5·5 to 7·2 $\mu$ in diameter after coming to rest. The spherical oogonia measure 24·5 to 40 $\mu$ in diameter (average 31·8 $\mu$) and the ellipsoidal or reniform, amphigynous or paragynous antheridia, 9·1 to 14·5 by 6·4 to 14·5 $\mu$ (11·5 by 9·7 $\mu$). The brown, globose, thick-walled oospores, 21 to 36·4 $\mu$ in diameter (average 28·2 $\mu$), germinate directly by a germ-tube. The intercalary or terminal, spherical chlamydospores measure 18·2 to 42·7 $\mu$ (30·6 $\mu$) and produce germ-tubes giving rise either to new chlamydospores or to sporangia.

The fungus grew best on bean, potato, oatmeal, and maize meal agars, the minimum, optimum, and maximum temperatures for development being 4·5°, 23°, and 33° C., respectively. The most favourable hydrogen-ion concentration was $P_H$ 5·5 to 6·4.

Inoculation experiments with the *Phytophthora* on healthy peonies and tree-peonies (*Paeonia moutan*) gave positive results, while the leaves and stems of tomato also contracted infection.

A comparison of the Japanese peony *Phytophthora* with *P. paeoniae*, *P. infestans*, and *P. thalictri* revealed its identity with the first-named [ibid., x, p. 755].

PALM (B. T.). **A note on Entyloma dahliae Syd. from Sumatra and Guatemala.**—*Phytopath.*, xxii, 10, pp. 868–869, 1932.

During 1924 and 1925 dahlias growing in elevated situations in Sumatra were observed to be severely attacked by *Entyloma dahliae* [*R.A.M.*, xii, p. 26]. The plant material had all been imported from Holland, where the disease must evidently be fairly widespread. On a recent visit to Guatemala, where the dahlia is indigenous, the writer also detected *E. dahliae* on *Dahlia coccinea*, one of the ancestors of the cultivated dahlia, while *D. excelsa* was apparently immune. It is believed that recent importations of the former species into botanical gardens and similar establishments in Europe for crossing purposes may account for the distribution of the fungus in that continent.

GUYOT (A. L.). **Au sujet du mode d'hivernation de certaines Urédinées parasites des Graminées.** [On the mode of overwintering of some Uredinaceae parasitic on Gramineae.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 6–7, pp. 186–190, 1932.

In this brief note the author discusses, on the ground of personal observations in France and of data in literature, the overwintering of *Puccinia coronata* [*P. lolii*] on *Lolium perenne* and other grasses, *P. glumarum* on *Dactylis glomerata*, and *P. bromina* on *Bromus sterilis* in the form of latent mycelium which persists in the host plant even through periods of great cold ($-7°$ to $-9°$ C.), and can form uredosori when the temperature again becomes favourable for its development.

WEIMER (J. L.) & MADSON (B. A.). **Alfalfa diseases in California.**—*California Agric. Exper. Stat. Circ.* 326, 19 pp., 7 figs., 1932.

The writers here summarize in popular form the available information on the following diseases affecting lucerne in California: bacterial wilt (*Phytomonas insidiosa*) [*Aplanobacter insidiosum*: *R.A.M.*, xi, p. 787], dwarf [ibid., x, p. 388], rust (*Uromyces medicaginis*), leaf spot (*Pseudopeziza medicaginis*), yellow leaf blotch (*Pyrenopeziza medicaginis*) [ibid., ix, p. 187], downy mildew (*Peronospora trifoliorum*) [ibid., xi, p. 304], bacterial blight (*Phytomonas* [*Bacterium*] *medicaginis*) [ibid., xi, p. 18], and crown wart (*Urophlyctis alfalfae*) [ibid., vii, p. 619].

THOMAS (P. H.) & RAPHAEL (T. D.). **The composition, application, and general effects of the main orchard sprays at present applied to pome fruits.**—*Tasmanian Journ. of Agric.*, iii, 4, pp. 145–153, 4 figs., 1932.

In this paper the authors briefly describe the composition and application of the main sprays used in Tasmania in the commercial control of fungal diseases and insect pests of pomaceous fruit trees, and give a few observations on their general effect both on the parasites and the hosts.

KRAATZ (W. H.). **Formalingas zur Bekämpfung der Erkrankung von Früchten auf dem Lager.** [Formalin gas for the control of fruit diseases in storage.]—*Obst- und Gemüsebau*, lxxviii, 10, p. 160, 1932.

The writer has obtained excellent control of the storage diseases of fruit, caused by various [unspecified] fungi, by fumigation of the storage room with formalin gas pastilles supplied by the Chemische Fabriken Schering-Kahlbaum A.-G., Berlin N. 65, Müllerstr. 170–171. Each pastille generates, on heating in a special apparatus provided with a small spirit lamp (Hygiea or Aesculap, obtainable from the above-mentioned firm), 1 gm. of 100 per cent. pure formalin gas, and one to two tablets are required per cu. m. of space. The process of fumigation occupies some seven hours, but it is advisable to keep the room closed for two to three days. The operation may be repeated if necessary after six to eight weeks.

WIESMANN (R.). **Untersuchungen über die Ueberwinterung des Apfelschorfpilzes Fusicladium dendriticum (Wallr.) Fckl. im toten Blatt, sowie die Ausbreitung der Sommersporen (Konidien) des Apfelschorfpilzes.** [Investigations on the overwintering of the Apple scab fungus *Fusicladium dendriticum* (Wallr.) Fckl. in the dead leaf, and on the dissemination of the summer spores (conidia) of the Apple scab fungus.]—*Landw. Jahrb. der Schweiz*, xlvi, 5, pp. 620–679, 13 figs., 6 graphs, 1932.

After a brief reference to the importance of the perfect stage in the overwintering of apple scab (*Venturia inaequalis*) [*R.A.M.*, xii, pp. 32, 102], the author's studies on the biology of the fungus, carried out at the Wädenswil Experiment Station, are reported in detail.

Perithecial maturation was found to depend in the first instance on a sufficiency of moisture, being accelerated by alternating wet and dry periods [cf. ibid., vi, p. 299; xi, pp. 112, 309, *et passim*]. Temperature is also important, the optimum for ascus and ascospore formation in Virginian Rose apple leaves being 17° C., with a minimum just above 0° and maximum at 29°. Good development occurred throughout the range from 13° to 21°. The ascospores survived 48 hours' exposure to a temperature of 32°. The time of perithecial maturation was further found to vary according to the period of autumn leaf fall, and in different varieties. The interplay of all these factors determines the actual date of the primary spring infection, on which in turn the extent of the scab injury largely depends. Thus, if primary infection by means of the ascospores occurs early in the spring (before blossoming), an epidemic is more likely to follow than in the case of relatively late attacks, when the foliage has developed a certain amount of resistance. This observation was exemplified in the experimental garden in 1931, when the Virginian Rose and Gravenstein varieties were infected before 1st May and suffered heavily from scab, while Wellington Reinette and Boiken were not attacked until the leaves had acquired a high degree of resistance during the warm, dry weather in May, and were consequently little affected.

Kept under dry conditions in the laboratory, the ascospores

of *V. inaequalis* were found to remain viable for considerable periods, a small percentage germinating after 38 days. Under dry conditions in the open the ascospores retained their viability for nearly five months. Spore trap experiments in 1931 showed that the apple scab ascospores were present in the air from the beginning of April to the middle of June, the above-mentioned primary infections being probably attributable to this source. Free ascospores could, however, only be trapped during or immediately after rain.

American workers have shown that wind, in the absence of rain, is ineffectual as an agent in the dissemination of conidia of *V. inaequalis*, and this observation was confirmed by the writer's tests, in which artificially induced velocities of 300 to 500 m. per sec. were necessary to detach any large number of the conidia from the leaves, a process readily effected by dropping water. This is far above velocities found in nature and it may be assumed that the conidia serve mainly for the dissemination of infection within a single tree. It was shown incidentally that the spores of certain other fungi, e.g., *Cladosporium fulvum* on tomato and *Monilia* [*Sclerotinia*] *fructigena* on apple, are detached by a wind velocity of 60 m. per sec.

BRIEN (R. M.). **'Delicious spot' on Apples due to Gloeosporium perennans.**—*New Zealand Journ. of Agric.*, xlv, 4, pp. 215–218, 2 figs., 1932.

Extensive investigation in 1930 and 1931 of the apple storage rot which was first recorded in New Zealand in 1923 by Cunningham under the name of 'Delicious spot' [*R.A.M.*, iv, p. 673], as it occurred most commonly on the variety Delicious, showed that it is caused by *Gloeosporium perennans* [ibid., x, p. 674; xi, p. 788], a brief English diagnosis of which is appended. The fungus is stated to agree closely with cultures received from Zeller in the United States. In New Zealand the rot appears to occur in all cool stores throughout the Dominion, chiefly on the varieties Delicious and Sturmer, and to a lesser extent on Rokewood, Statesman, and Washington. Observations in nature, confirmed by laboratory tests, indicate that infection usually takes place through mechanical injuries and necrotic areas resulting from sun or spray scorch and the like; under favourable conditions, however, the fungus can enter through the lenticels, and may then cause numerous lesions scattered all over the surface of the fruit. Besides the varieties named above, inoculations also produced typical rot in Jonathan and Cox's Orange apples.

TILLER (L. W.). **A superficial spotting disease of the Lord Wolseley Apple.**—*New Zealand Journ. of Sci. & Techn.*, xiv, 2, pp. 111–113, 1 fig., 1932.

In 1928 attention was drawn by Dr. Barker, of the Cambridge Low Temperature Research Station, to the occurrence of a scald-like spotting on New Zealand Lord Wolseley apples purchased in England. The spots are yellowish-brown at first, later turning to a buckthorn-brown or ochraceous-tawny, and finally assuming a Dresden or cinnamon-brown tinge (Ridgway's Color Standards).

The lesions are generally situated at the lenticels, and they gradually enlarge and become slightly sunken. The diseased areas are very susceptible to fungous invasion.

It was found that late picked (31st March) fruit is much more susceptible to the spotting than that gathered earlier (8th), while storage at 32° F. reduced the amount of injury as compared with 38°. The use of oiled wrapping paper did not give sufficient control to justify the expense of this treatment.

The disturbance, which is generally more severe at the stalk than at the calyx end of the apple, was found to be a photochemical effect following exposure to sunshine. It did not occur among fruit kept in a container from which light was excluded. Other varieties developing this form of spotting under similar conditions were Granny Smith, Cleopatra, and London Pippin.

SMITH (R. E.). **The diamond canker disease of the French Prune in California.**—*California Agric. Extens. Serv. Circ.* 67, 22 pp., 14 figs., 1932.

The macroscopic symptoms of diamond canker of French (Agen) prunes in California [*R.A.M.*, xii, p. 79] consist of a marked thickening of the bark on the trunk and main limbs. The diseased cortex is rough, black, and corky, with a tendency to split both length- and cross-wise, especially at the twig bases and over pruning cuts, resulting in the typical diamond-shaped cankers. Once a tree is affected the disease usually spreads right through it, proceeding regularly upwards on the limbs in such a way as to suggest systemic infection, a theory confirmed by the development of characteristic symptoms on the suckers arising from the cankered forks. Towards the tips of these suckers the superficial bark layers show a longitudinal purplish streaking and a tendency to flake off. Old trees sometimes show a kind of perennial canker. Infection appears to originate in wound-healing tissue. The only organism consistently isolated from diseased trees during the last five years is *Dematium pullulans*. Inoculation experiments with cultures of this organism have given negative results, but in one case the inoculation of a pruning cut with a slice of diseased bark was followed after two years by the appearance of typical diamond canker.

Control measures should be directed towards the prevention of wounds, sunburn, and bacterial gummosis [ibid., viii, p. 550; ix, p. 598] by covering the trunks with a heavy coating of Bordeaux mixture or whitewash. Top-grafting with myrobalan [*Prunus divaricata*] sprouts has sometimes given good results, and temporary benefit may be derived by the excision of cankers and disinfection with mercuric chloride or Bordeaux paste, as well as by scraping off the rough outer bark and painting the exposed limbs with Bordeaux mixture or copper carbonate solution.

PFEIFFER. **Von den Sorgen der Gummierkrankung unserer Kirschbäume.** [Precautions against gummosis of our Cherry trees.]—*Zeitschr. für Obst-, Wein- und Gartenbau*, lviii, 10, pp. 203–205, 1932.

The writer's extensive observations on gummosis of cherry,

plum, peach, and apricot trees in Saxony indicate that the disease, in its local form, is attributable rather to unfavourable cultural conditions (e.g., heavy clay soils) than to bacterial invasion, though isolated cases of the latter do occur [cf. *R.A.M.*, viii, p. 182 *et passim*]. The remedy, in his opinion, lies in liberal applications of lime, which prevent the accumulation of oxalic acid in the trees with the consequent dissolution of the wood fibres and exudation of gum through the cortex.

VOGLINO (P.). **Sopra un grave deperimento delle foglie di Nespolo.** [On a serious leaf wilt of Medlars.]—*La Difesa delle Piante*, ix, 5, pp. 69–70, 1932.

At the end of August, 1932, numerous medlar trees (*Mespilus germanica*) in the vicinity of Susa, north Italy, became attacked first by *Entomosporium mespili* [*Fabraea maculata*] [*R.A.M.*, vi, p. 528] and subsequently by *Phyllactinia suffulta* [*P. corylea*: ibid., x, p. 343], the double attack producing a leaf wilt which became progressively worse and checked the development of the last fruits. Other medlars growing under identical conditions but sprayed in June and July with Bordeaux mixture were but slightly attacked and bore a normal crop.

HOCKENYOS (G. L.) & IRWIN (G. R.). **Studies on Bordeaux deposition.**—*Phytopath.*, xxii, 10, pp. 857–860, 1932.

A tabulated account is given of the laboratory studies conducted at Urbana, Illinois, to ascertain the effect of a wetting agent on the uniformity of the deposit of 4–4–50 Bordeaux mixture on the leaf surface, and on the total deposit per unit area.

The apparatus used in spraying the leaves (cherry) was a Hudson hand sprayer operated by 10 lb. air pressure. The spray was directed against a perpendicular board to which the leaf to be sprayed was fastened. The period of exposure of the leaf to the spray was regulated by a pendulum-shutter, each swing corresponding to two seconds. After spraying the leaves were dried and sections cut from them and analysed for copper by the method previously described [*R.A.M.*, x, p. 475].

The amount of copper per sq. in. on a leaf sprayed for 12 seconds at a distance of 13 in. with Bordeaux mixture without a wetting agent was found to be 0·00011 gm., the corresponding figures for 16, 20, and 24 seconds being 0·00020, 0·00015, and 0·00010 gm., respectively. The run-off thus began at 20 seconds.

In a second test on apple leaves (11 in. distant) Bordeaux mixture alone was compared with the same plus 0·04 per cent. dried-blood albumin as a wetting agent. It was found that the latter, while not decreasing the amount of copper deposited, did eliminate the formation of heavy spots and to some extent augmented the uniformity of the deposit. The amount of copper per sq. in. ranged from 0·00009 to 0·00011 gm., run-off beginning in 6 seconds. In a further experiment on peach leaves it was shown that the under surface is capable of holding roughly twice as much copper as the upper, and that the various wetting agents employed

(1 per cent. colloidal clay, 0·5 per cent. soap, 0·125 per cent. kayso, gum ghetti, or waste pulp liquor, and 0·05 blood albumin) produced little effect on the amount of copper deposited. The times required for complete wetting of the leaves by Bordeaux mixture alone ranged from 5 to 45 seconds, the corresponding figures for the same plus the best wetting agents (soap, blood albumin, and kayso) being 4 to 5, 6 to 7, and 5 to 9 seconds, respectively.

It may be inferred from the data given above that the addition of wetting agents to Bordeaux mixture will somewhat increase the uniformity of the deposit and prevent the formation of heavy spots without diminishing the quantity of copper deposited per unit area.

De Ong (E. R.). **Fungicidal value of pine-tar oil and copper resinate.**—*Phytopath.*, xxii, 10, pp. 861–864, 1932.

Petroleum oil is a valuable insecticide but its lack of fungicidal efficacy has hitherto been a serious drawback where a combined oil-fungicidal spray is required. During the past four years research has been carried out on an oil known as palustrex, distilled from the pine tree and specifically adapted for use as a spray on plants. This preparation is a more active fungicide than the petroleum fractions used for foliage spraying, and is, moreover, an active solvent for copper resinate. A copper resinate solution in oil can thus be prepared.

Field tests of the copper-oil sprays have confirmed laboratory data by showing the superior efficacy of these preparations to Bordeaux mixture in the control of walnut blight [*Bacterium juglandis*: *R.A.M.*, xi, p. 772] and cantaloupe mildew (*Erysiphe cichoracearum*) [ibid., x, p. 702]. In a laboratory test of the comparative toxicity of copper resinate and copper sulphate to the spores of *Monilia* [*Sclerotinia*] and *Botrytis*, the latter was found to be slightly more effective, but the physical superiority of the oil-soluble spray (lower surface tension, increased penetration, and wax-dissolving capacity) could not be taken advantage of under the conditions used in the test. Copper resinate contains 9·5 per cent. metallic copper as against 25·4 per cent. in Bordeaux mixture, the low content being a further advantage from the standpoint of metallic residues on fruit and vegetables. The very light and somewhat sticky consistency of copper resinate renders it difficult to mix with oil, so a paste is now being put on the market containing 70 per cent. of the salt dissolved in palustrex.

Bondartzeff (A. S.). **Болезни культурных растений и меры борьбы с нимн.** [Diseases of cultivated plants and their control.]—vii + 600 pp., 490 figs., 3rd revised and augmented ed., State Publishing Office of Agric. & Collective Farming Cooperative Literature, Leningrad, 1931. [Received December, 1932.]

This is a comprehensive text-book, designed chiefly for Russian advanced students in phytopathology, dealing with the chief physiological, bacterial, fungal, and virus diseases of cultivated crops and forest trees, with particular reference to those that occur in

the Russian Soviet Republics. A large proportion of the figures are original. Considerable space is given to recent attainments in the control of the diseases, and the book terminates with a list of the more important parasitic organisms, grouped under the Russian common names of the hosts, and with the indication of the main symptoms caused by them.

LAING (E. V.). **Studies on tree roots.**—*Forestry Comm. Bull.* 13, 73 pp., 17 pl., 2 figs., 5 diags., 1 graph, 1932.

Following an introductory description of the root system of a conifer and an account of the mycorrhiza on various genera, with notes on the associated fungi, the author discusses the soil conditions affecting the occurrence and distribution of mycorrhiza in Great Britain. An essential condition for mycorrhizal formation by first-year Scots pine (*Pinus sylvestris*) seedlings is that the ground used for the seed should have recently been under some kind of tree. This is exemplified by the poor growth of pine and also of larch seedlings in new nurseries formerly used for agricultural purposes. Isolated cases of mycorrhizal formation do occur, however, in such nurseries, and it has been observed that the seedlings with fungus (usually *Cortinarius mucosus* on Scots pine and larch) roots are much more vigorous than the others.

The production of mycorrhiza is liable to be inhibited in the poorer types of peat soil; and here again only the individuals with fungus roots are able to thrive. Mycorrhizal formation was not observed in peat of the *Calluna-Eriophorum-Erica* type except where the fungus was brought into contact with the tree roots. It has been found, however, that even in poor types of peat fungus roots may be formed following the admixture with the soil of oxidizing inorganic salts, especially magnesium carbonate, or fertilizers such as basic slag.

Evidence is available that the production of mycorrhiza also depends to a certain extent on the condition of the plant. Fungus roots are uniformly found on the more vigorous plants in all soils. Mycorrhiza are never formed on trees growing in water or in very wet peats; they occur only in those peat soils undergoing rapid oxidation, and wherever there is aeration of the peat, mycorrhiza will appear. No direct connexion was traced between the presence or absence of mineral bases in the peat solution and the formation of mycorrhiza. Where aeration occurs without the presence of mineral bases the 'ball' type of ectotrophic mycorrhiza is represented, the 'coralloid' type resulting from a combination of aeration and mineral bases.

It was apparent from the author's observations that the most successful tree growth in peat soils occurs where there is an equal proportion of 'fungus' and ordinary roots. In certain peat soils the mycorrhizal fungus may retard the longitudinal growth of the sub-lateral roots, while under adverse conditions the organism may assume a parasitic form and destroy the roots of the trees with which it is associated.

The bearing of these observations on the growing of conifers in peat and other classes of soils is discussed.

CHONA (B. L.). **Studies in the physiology of parasitism. XIII. An analysis of the factors underlying specialization of parasitism, with special reference to certain fungi parasitic on Apple and Potato.**—*Ann. of Botany*, xlvi, 184, pp. 1033–1050, 2 graphs, 1932.

This is a detailed account of the author's experiments [conducted on the same lines as those of Vasudeva: *R.A.M.*, ix, pp. 545, 798], in which he tested the behaviour on apples and potatoes of three fungi normally parasitic on the potato, namely, *Fusarium coeruleum* [ibid., x, p. 795; xi, p. 669], *Phytophthora erythroseptica* [see above, p. 141], and a species of *Pythium* (? *de Baryanum*), and of two fungi normally parasitic on apples, namely, *Botrytis cinerea*, and two strains of *Fusarium fructigenum* [ibid., xi, p. 306] (strains D and Biii, the latter of which was very weakly parasitic). The results showed that under normal conditions the potato parasites were unable to attack apple tissue, and the apple fungi did not rot the potatoes, but when a source of nitrogen was added to the inoculum *F. coeruleum* was able to invade apple tissues to a certain extent; nitrogen also appeared to increase the virulence to apples of *B. cinerea* and *F. fructigenum* strain D. Advancing maturity diminished the resistance of the apples to *F. fructigenum* strain D, and of the potatoes to *F. coeruleum*; when fully ripe, the apples were rotted by the latter species and by the very weakly parasitic *F. fructigenum* Biii strain.

Experiments further showed that the failure of the normal parasites of the one host to attack the other was not due to any inhibiting effect of the juice of the latter on the germination of the spores, but rather to the deactivating action of the juice on the enzymes produced by the fungi. The active principle in the potato juice appeared to be its mineral content, more particularly magnesium and potassium phosphate, and that of the apple juice, the concentration of malic acid. The pectinase enzyme of the *Pythium* was found to have its greatest activity on the alkaline side of neutrality, and to be very sensitive to an acid reaction, the reverse being true of the enzyme of *B. cinerea*. Potato juice was also shown to render certain plant tissues, e.g., potato and turnip, more resistant to the action of *B. cinerea*.

PASINETTI (L.). **La patogenicità della 'toile' in rapporto all'azione dei raggi X.** [The pathogenicity of the 'toile' organism in relation to the action of X-rays.]—*Riv. Pat. Veg.*, xxii, 7–8, pp. 201–217, 1 pl., 1932.

Although exposure of the mycelium of the asporogenous strain of *Botrytis cinerea* shown by Beauverie to cause the well-known 'toile' disease [*R.A.M.*, x, p. 612] to the action of X-rays (3 MA., 100 KV., D.F. cm. 20, filterless) for five to thirty minutes failed to attenuate the virulence of the fungus as tested by laboratory inoculations on pea and bean [*Phaseolus vulgaris*] seedlings, it was noted that 24 hours after exposure for some 20 minutes the irradiated mycelium was growing much more actively than the unexposed, the difference between the two becoming progressively greater throughout a period of four or five days. The exposed hyphae were brighter, more branched, and usually wider

than the unexposed, and their cytoplasm showed smaller and more numerous granules. As the sclerotial stage was approached emptying of the hyphae was more frequent in the exposed mycelium. Forty-eight hours after exposure the mycelium began to yellow rapidly, and it reached the pre-sclerotial stage when the unexposed mycelium was only beginning to turn yellow. Cultures from transfers originally exposed for 10 to 30 minutes reached an equivalent stage of growth in 48 hours to that reached in 72 hours by transfers from unexposed cultures. With the fifth or sixth transfer the stimulation imparted by the rays became imperceptible. The exposures did not induce spore formation. Higher dosages and longer exposure rapidly arrested growth.

PASINETTI (L.). **Le variazioni micro-termo-elettriche in alcuni eumiceti patogeni delle piante irradiati con raggi X.** [The micro-thermo-electrical variations in certain Eumycetes pathogenic to plants after exposure to X-rays.]—*Riv. Pat. Veg.*, xxii, 7–8, pp. 219–264, 1 pl., 1 diag., 4 graphs, 1932.

When cultures of the asporogenous strain of *Botrytis cinerea* [see preceding abstract] were exposed for five to thirty minutes to the action of X-rays (3 MA., 100 K.V., 30 cm. D.F., filterless) and their temperature was afterwards measured at intervals of 24 hours (up to 168 hours) by a special thermo-electrical technique [which is described] it was found that the exposures brought about an increase in temperature closely associated with heightened cellular activity; intracellular combustion was increased and the vital processes of each cell-unit accelerated until it died or its vital activities became prematurely arrested.

Twenty-four hours after the exposures had been made, the average temperature of the unexposed controls was 0·2452° C. higher than that of the surrounding atmosphere, this figure rising to a maximum of 0·3668° 48 hours later and falling to 0·3156° after a further 96 hours. The corresponding figures for the cultures exposed for five minutes were 0·7545°, 0·9485°, and 0·432°, those for the ten-minutes' exposures showing a parallel rise and fall. Exposure for both these periods temporarily stimulated cellular activity without inducing any appreciable protoplasmic changes.

In the cultures exposed for 15 to 30 minutes the latency period was protracted up to about 24 hours after exposure. When this phase had passed, the physio-cellular and vital functions were strongly activated. In this latency period, 24 hours after the cultures had been exposed for 15 minutes, their temperature averaged only 0·258° higher than that of the surrounding atmosphere, while the corresponding figures for 48, 144, and 168 hours after exposure were, respectively, 0·5800° (0·3746° in the controls), 0·8420° (0·3542° ), and 0·8330° (0·3156°).

When the exposures lasted for 20 minutes the latency period was shorter. Twenty-four hours after exposure for this period the average temperature of the cultures was 0·619° higher than that of the surrounding atmosphere, the corresponding figures after 48, 72, 96, 120, 144, and 168 hours being, respectively, 1·091°, 0·8565°, 1·004°, 0·645°, 1·031° and 0·9664°. The increase in cellular activity was greater in this series than in any other.

Exposure for 25 and 30 minutes caused somewhat similar effects to exposure for under 20 minutes, the thermal behaviour of the former being due to excessive, and that of the latter to insufficient exposure.

When a strain of *Pythium de Baryanum* was used a closely similar acceleration of thermogenesis took place, exposure for 20 minutes again giving the optimum results.

Brodie (H. J.). **Oidial mycelia and the diploidization process in Coprinus lagopus.**—*Ann. of Botany*, xlvi, 184, pp. 727–732, 1932.

After a brief reference to a previous communication in which he described the structure and function of oidia borne on the haploid mycelia in *Coprinus lagopus* [*Ann. of Botany*, xlv, pp. 315–344, 1931], the author gives details of further experiments in which he established that oidial mycelia (i.e., derived from oidia) of opposite sex are able to diploidize one another, as shown by the formation of clamp-connexions. The same was also true of haploid mycelia of opposite sex derived from basidiospores (basidiosporous mycelia), and oidial mycelia of one sex were also diploidized by basidiosporous mycelia of the opposite sex. It was further shown that the oidial mycelium of *C. lagopus* grows indefinitely without producing haploid fruit bodies when not diploidized by a mycelium of the opposite sex.

Vandendries (R.) & Martens (P.). **Oïdies haploïdes et diploïdes sur mycélium diploïde chez 'Pholiota aurivella' Batsch.** [Haploid and diploid oidia on a diploid mycelium in *Pholiota aurivella* Batsch.]—*Bull. Cl. Sci. Acad. Roy. de Belgique*, Sér. V, xviii, 5, pp. 468–472, 3 figs., 1932.

Cultures of *Pholiota aurivella*, in which bipolar heterothallism occurs, were found to bear numerous oidiophores on hyphae showing clamp-connexions and therefore belonging to the diploid mycelium. This is entirely contrary to the usual habit of the higher Basidiomycetes, which bear their uninuclear, haploid oidia on a primary thallus [see preceding abstract]. The diploid mycelium in *P. aurivella* produces three types of oidia, viz., cylindrical, concatenate, and binucleate; ovoid, single, and binucleate; and fusiform, single or in groups, becoming uninucleate by transverse division. The two first-named types immediately give rise to normal diploid mycelia, while the third may either liberate each cell separately as a haploid oidium giving a haploid mycelium or may revert to the diploid condition.

**Tätigkeitsbericht des Kartoffelfachausschusses über das Jahr 1932.** [Report on the work of the Committee of Potato Experts during the year 1932.]—*Neuheiten auf dem Geb. des Pflanzensch., 1932*, 5–6, pp. 101–108, 1932.

The following items of phytopathological interest (by [R.] Fischer and [H.] Neumann) occur in this report. A root rot of potatoes caused by *Rhizoctonia* [*Corticium solani*] was very prevalent in Austria during 1932. The younger leaves of affected

plants assumed a reddish tinge, wilting and rolling of the foliage ensued, and the stunted tubers were of a rubbery consistency. The rotted base of the plants usually displayed deep fissures and was often enveloped in the whitish mycelium of the fungus, associated with which were species of *Fusarium* and occasionally *Verticillium*. The trouble was apparently confined to regions in which the dry, hot weather of May and June was accompanied by heavy local showers, inducing the formation of cracks in the strongly suberized basal tissues. The optimum temperature for the development of the fungus (22° to 25° C.) was maintained for weeks at a time.

None of the preparations used in soil disinfection tests against the wart organism [*Synchytrium endobioticum*: *R.A.M.*, xi, p. 321] was at all effective with the exception of sulphur, which slightly reduced the incidence of infection.

Experiments in the reaction of 59 potato varieties to *Phytophthora* [*infestans*: ibid., xi, p. 71] showed that four escaped both leaf blight and tuber rot, nine were resistant to the former but susceptible to the latter, 18 contracted leaf blight but not tuber rot, while 28 were susceptible to both forms of the disease.

FOLSOM (D.). **Potato virus diseases in 1931.**—*Amer. Potato Journ.*, ix, 10, pp. 173–181, 1932.

A survey is given as in previous years [*R.A.M.*, x, p. 484] of recent American and European literature (1930–1) on virus diseases of potatoes (psyllid yellows [ibid., x, p. 65], mosaic of various types, masked and otherwise, spindle tuber and unmottled curly dwarf [ibid., x, p. 264], and leaf roll).

MUNCIE (J. H.). **Yellow dwarf and 'moron' diseases of Potato in Michigan.**—*Proc. Eighteenth Ann. Meeting Potato Assoc. America, 1931*, pp. 70–73, 1932. [Received January, 1933.]

In 1931 yellow dwarf of potatoes [*R.A.M.*, xi, p. 48] was observed in 134 fields in 19 counties of Michigan, as compared with 32 fields in 8 counties in 1929. In one field where 0·5 per cent. of infection was found in 1929 and none in 1930, 24 per cent. occurred in 1931. In another instance 50 per cent. of the plants were affected in 1931 as against only 0·1 per cent. in 1930. The difficulty of recognizing the primary stages of the disease may be largely responsible for its rapid spread. Thus, in 1930 about 6,000 seedlings were grown in the greenhouse and transplanted in June to a plot three-quarters of a mile from any other potatoes. Careful inspection failed to reveal any yellow dwarf in these plants during the growing season, and 97 hills were saved and planted in units in 1931 about a quarter of a mile from other potatoes [cf. ibid., xii, p. 50]. During early June 26 entire units, and in August five additional plants were rogued out for yellow dwarf. No evidence of soil infection has been obtained. Inoculation tests have resulted in a few cases in a slight brown flecking of the pith and cortex of the nodes at the tip of the shoots, one of the early symptoms of the disease, but the significance of this is not yet clear.

The so-called 'moron' disease is characterized by abnormally pale, later greyish-green foliage, pointing and sometimes slight rolling of the apical leaves, enlargement of the stem nodes, and shortening of the internodes. In the later stages the russet varieties assume an erect, bushy habit of growth, the stems turn reddish-purple, and the leaves show marked rolling near the tips. The pith and cortical tissues of the stems usually show distinct flecking near the base. One or more of the tubers may be flabby and they generally exhibit a brown discoloration of the cortical layer, often extending throughout the tuber. The trouble may be due to defective starch translocation. Careful roguing reduces the disease to a minimum.

MARTIN (W. H.). **Report of the Seed Potato Certification Committee.**—*Proc. Eighteenth Ann. Meeting Potato Assoc. America, 1931*, pp. 115–124, 1932. [Received January, 1933.]

During the autumn of 1931 the authorities in charge of seed potato certification in the various American States and Canada were asked whether they approved of the standards suggested the previous year [*R.A.M.*, x, p. 484]. In most cases affirmative replies were returned, but a number of suggestions [which are summarized] were made for modifications of the standards in various particulars.

BAILEY (H. L.). **Report of the Division of Seed Potato Certification.**—*Sixteenth Bienn. Rept. Vermont Commissioner of Agric. 1930–32*, pp. 80–85, 1932.

During 1930 virus diseases of potatoes, especially leaf roll, were prevalent in Vermont, and only 436 acres were certified out of 744 inspected. In 1931, however, conditions in this respect were much better, with the result that 92 per cent. of the 854 acres inspected were passed as fit for seed [cf. *R.A.M.*, x, p. 267]. This favourable outcome is attributed largely to the use of the best home-grown stock supplemented by highest grade Canadian (Prince Edward Island and New Brunswick) seed. Some details are given of the testing methods adopted.

SEVENSTER (A.). **Plants de Pomme de terre de Hollande.** [Seed Potatoes from Holland.]—*Journ. d'Agric. Prat.*, N.S., xcvi, 41, pp. 306–307, 1 fig., 1932.

As from 26th May, 1932, the two Dutch seed potato-testing organizations formerly known, respectively, as the Central Committee for Crop Control in the Netherlands (C.C.) and the Institute of Cereals and Seed Potatoes (K.I.Z.), have been merged in a single body, the General Service of Crop Control in the Netherlands ('Nederlandsche Algemeene Keuringsdienst' or N.A.K.) [cf *R.A.M.*, ix, p. 263]. By a Royal Decree of 3rd June, 1932, the export of seed potato tubers is permitted only under the supervision of this organization, which issues certificates giving information in different languages as to the grade of the consignment (A = excellent, B = good, and C = satisfactory), variety, dimensions of the tubers, kind of soil in which the crop was cultivated, and the like.

BOYSEN (H.). **Flatskurv—Actinomyces-skurv—og jordreaksjon. Noen iakttagelser fra Hvam forsøksgård.** [Flat scab—*Actinomyces* scab—and soil reaction. Some observations from the Hvam experimental farm.]—Reprinted from *Tidsskr. Norske Landbruk, 1932*, 10, 6 pp., 1932.

Details are given of the occurrence of potato scab (*Actinomyces* spp.) [*A. scabies* and related forms] on an experimental farm in Norway during the years 1925, 1926, 1927, and 1930. The soil was of a very poor sandy heathland type.

In 1925 the potatoes (Louis Botha) received 23 or 40 kg. per hect. of superphosphate or basic slag, a control plot being left untreated. The soil reaction fluctuated between $P_H$ 4·1 and 4·4. The highest incidence of infection (48 per cent.) occurred on the plot receiving 20 kg. basic slag and the lowest (27 per cent.) on that to which 40 kg. superphosphate was applied. In 1926 there was 64 per cent. scab on a plot receiving 4,500 kg. lime and 300 cu. m. clay per hect., 49 per cent. on one receiving the same quantity of lime alone, 41 per cent. on that with clay alone, and 34 per cent. on an untreated plot. The hydrogen-ion concentration of the most severely infested areas was $P_H$ 4·4 to 4·5. The highest incidence of scab (72 per cent.) in Sagerud potatoes in 1927 occurred on a plot given 80 kg. Dalen cement-potash-lime and 3,000 kg. lime per hect. in 1926, 70 per cent. being recorded on one receiving 80 kg. 40 per cent. potash and 3,000 kg. lime in 1926 and the same amount of the Dalen mixture yearly (soil reaction $P_H$ 4·3 and 4·8, respectively). The scab percentages on the plots receiving 80 kg. 40 per cent. potash, the same with the Dalen mixture, the Dalen mixture alone, and no fertilizer were 36, 46, 42, and 27, respectively (reaction $P_H$ 3·6 to 3·7). A further experiment was conducted in 1930 with clay and lime, using the moderately resistant King George V variety, the infection percentages being as follows: 35·9 on a plot given 5,000 kg. lime per hect. ($P_H$ 6·08), 32·5 on one receiving 150 cu. m. clay and 5,000 kg. lime, 21·1 where 300 cu. m. clay was applied, and 13·7 on the control ($P_H$ 3·65).

Meteorological records show that the rainfall in 1925 was below normal, in 1926 and 1927 much above normal, and in 1930 normal. The summers of 1925 and 1926 were warm, 1927 was cool, and 1930 normal.

The striking feature of these experiments is the occurrence of scab at the very acid soil reaction of $P_H$ 3·6.

NEUWEILER (E.). **Der Kartoffelkrebs in der Schweiz.** [Potato wart in Switzerland.]—*Landw. Jahrb. der Schweiz*, xlvi, 5, pp. 680–688, 1 map, 1932.

Of the 25 centres of potato wart (*Synchytrium endobioticum*) infection detected in Switzerland from 1925 to 1930 [*R.A.M.*, xi, pp. 120, 468], covering a total area of 2 to 3 hect., 17 are directly or indirectly traceable to imported seed stocks, while the remainder may be attributed to soil infestation or other modes of dissemination. In 1931 the disease was found to have spread very considerably, being detected in 57 centres, mostly on seed stocks of the Alma variety imported from an East Prussian farm, though in

two localities the Kaiserkrone and Frühe Rosen varieties were also involved. The potato-exporting farm has for many years enjoyed a high reputation for the production of first-class seed stocks, and it is certain that the presence of infection among the tubers was quite unknown to the authorities, who had, moreover, sanctioned the distribution of large quantities of this seed throughout East Prussia. The infection was of a mild type but it spread extensively, assuming a more severe form in heavy soils, while the development of the fungus was also favoured by the damp season of 1931. The present distribution of the disease in Switzerland is shown by a map.

Drastic legislative measures have been enforced by the Swiss Federal and local agricultural bodies to prevent any further spread of the disease beyond the 38 hect. now infested. Crops from these fields are to be removed to special places of storage and either used for fodder (after acidification) or otherwise disposed of at the discretion of the officials in charge. All the plant refuse in the field must be collected and destroyed, and lime strewn over the soil at the rate of 20 kg. per are. For a number of years infested fields must be used for pasturage, after which they, together with any areas in which the presence of wart disease is suspected, are to be planted exclusively with immune varieties. Potatoes from suspected fields are to be used, as far as possible, for home consumption, or otherwise to be supplied to such centres as Zürich in which proper arrangements exist for the incineration of rubbish. Compensation is allowed at the rate of Fr. 8 per 100 kg. for unsorted requisitioned tubers and at Fr. 4 for those used for fodder on infected farms. Disinfectants, e.g., lime and formalin, are to be purchased on co-operative lines at the expense of the cantons, which in turn will be indemnified by the Federal departments concerned to the extent of 50 per cent. of the outlay.

Pending the entire reorganization of the Swiss potato industry through the use of immune varieties, the limited cultivation of the following commercially important susceptible sorts will be allowed during the transition period: (a) early: Frühe Rosen, Zwickauer frühe Gelbe; (b) medium-early: Alma (Millefleurs), Allerfrüheste Gelbe, Odenwälder Blaue, and Up-to-Date; (c) late table: Industrie, Centifolia; (d) late industrial: Wohltmann. Ultimately the following immune varieties will be used: (a) Rosafolia, Kuckuck, and Frühe Amerikaner; (b) Great Scot, King George, Weltwunder, and Erdgold; (c) Ackersegen, Jubel; (d) Parnassia.

REDDICK (D.), CROSIER (W. F.), & MILLS (W. R.). **Blight immune Potato hybrids.**—*Proc. Eighteenth Ann. Meeting Potato Assoc. America, 1931*, pp. 60–64, 1932. [Received January, 1933.]

Promising results have been obtained at Ithaca, New York, by hybridization experiments between the wild Mexican *Solanum demissum*, which is immune from potato blight (*Phytophthora infestans*) [*R.A.M.*, xi, p. 672] and the cultivated Smooth Rural variety. Although the number of plants involved is small, the records to date indicate that the immunity of *S. demissum* is carried over into the first and second hybrid generations and into

back crosses (using the Ekishirazu variety) [ibid., vii, p. 738] to a considerable extent.

ZILING (M. K.). Материалы к познанию микофлоры почв Зап. Сибири. Предварительные итоги работы **1931** г. [Contribution to the knowledge of the fungal flora of West Siberian soils. Preliminary results of the work done in 1931.]—ex *Болезни Зерновых Культур*. [*Diseases of cereal crops*], issued by *Siberian Scient. Res. Institute for Cereal Industry*, Omsk, pp. 40–61, 1932.

This is a detailed account of the preliminary results obtained in 1931 in the investigation, started in that year, of the fungal flora of soils under cereals and grass in the neighbourhood of Omsk, with particular reference to fungi of phytopathological interest. Species [mostly unspecified] belonging to 36 genera were recognized, of which representatives of *Penicillium*, *Fusarium*, Mucoraceae, *Cladosporium*, *Alternaria*, *Aspergillus*, and *Botrytis* were the most common and most numerous. No significant correlation has so far been observed between the various methods of cultivation of the soil and the numbers and composition of its fungal flora.

Special attention was given to the genus *Fusarium*, as being the most dangerous, under local conditions, to cereal crops, and an annotated list is given of 15 species or forms which were identified. The outstanding fact revealed by the investigation was the extensive occurrence in all the soils of the more pathogenic *Fusarium* spp., particularly *F. oxysporum* which was practically omnipresent. Continued cultivation of wheat for several years on the same land did not appear to increase the content of the soil in *Fusarium* spp., and, on the other hand, winter or spring bare fallow did not appear to reduce their numbers. Another striking fact was that the number of pathogenic species of *Fusarium* was considerably increased in soil put under grass, especially *Agropyrum tenerum*, for six years, as compared with soils under wheat. This fact throws considerable doubt on the value of grass for the regeneration of soil fertility.

KUBIENA (W.). **Über Fruchtkörperbildung und engere Standortwahl von Pilzen in Bodenhohlräumen.** [On fruit body formation and the specific choice of habitat by fungi in soil cavities.]—*Arch. für Mikrobiol.*, iii, 4, pp. 507–542, 25 figs., 1 diag., 1932.

The writer's micro-analytical investigation of Austrian soils by an improved technique [which is described in detail] revealed the presence of fructifications of *Mucor racemosus*, *M. alternans*, *M.* sp., *Rhizopus nodosus* [*R.A.M.*, xi, p. 554], *Achlya gracilipes*, *Oedocephalum glomerulosum*, *Hyalopus crystallinus*, *Mycogone* sp. (?), *Sporotrichum* sp. (?), *Acladium* sp., *Coëmansia* sp., *Periconia* sp., *Cladosporium* sp., *Penicillium* sp., and *Actinomyces* sp. Notes are given on the types of soil in which these species were encountered, and Waksman's observation that the number and varieties of fungi increase with the improved cultivability of the soil was confirmed.

Weindling (R.). **Trichoderma lignorum as a parasite of other soil fungi.**—*Phytopath.*, xxii, 10, pp. 837–845, 4 figs., 1932.

Cultures of an extremely virulent, fast-growing strain of *Rhizoctonia* [*Corticium*] *solani*, as well as of *Phytophthora parasitica*, *Pythium* spp., *Sclerotium rolfsii*, and *Rhizopus* sp., all isolated from damped-off citrus seedlings in California, were parasitized by *Trichoderma lignorum* [*R.A.M.*, xi, p. 414]. The inhibition and death of the host fungus were caused either by close contact or coiling of the parasite round the aerial hyphae, or by the toxic action of the parasite at a short distance in the case of the submerged mycelium. *Pythium* spp. and *Phytophthora parasitica* seemed in general to be more readily overcome than *C. solani* by *T. lignorum*. The results of preliminary pot experiments indicate the possibility of the practical control of damping-off in citrus nurseries by abundant inoculation of the soil with cultures of *T. lignorum*, which is quite harmless to the seedlings.

McRae (W.). **Effect of mosaic on the tonnage and the juice of Sugar cane in Pusa, Part II.**—*Indian Journ. Agric. Sci.*, ii, 4, pp. 378–384, 1932.

Details are given of carefully controlled plot experiments at Pusa to determine the effect of mosaic on the tonnage and juice of sugar-cane [*R.A.M.*, xi, p. 425], the results of which showed that diseased Co. 213 was 11 per cent. less in germination after seven weeks, 14·8 per cent. less in yield of stripped cane, 8·9 per cent. lower in yield of juice, slightly less in brix, and 4 per cent. lower in sucrose than healthy cane.

Verwoerd (L.) & Du Plessis (S. J.). **Descriptions of some new species of South African fungi and of species not previously recorded from South Africa. IV.**—*S. African Journ. of Sci.*, xxix, pp. 313–316, 1932.

Among other new species of fungi and fresh records for South Africa [*R.A.M.*, xi, p. 267] the following may be mentioned. *Phoma fici caricae* n. sp. causes a fig canker at Stellenbosch. The subcuticular, depressed globose or semi-elliptical, pycnidia, measuring 106·5 to 227·2 by 99·4 to 191·7 $\mu$, are situated in the greyish-white central portions of irregularly longitudinal branch cankers; the ostiole is circular to elliptical, depressed or occasionally slightly papillate, 5 to 10·2 by 3·4 to 9·5 $\mu$; the peridium smooth, membranous, black, 8·5 to 15·3 $\mu$ thick; the pycnospores continuous, smooth, hyaline, elliptical to ovoid, muticate, 3 to 4·5 by 1·4 to 1·7 $\mu$; and the conidiophores hyaline, simple, pointed, 2·6 to 3·4 by 1·2 to 1·5 $\mu$.

On onion leaves irregular, grey spots, spreading from the top downwards, are formed by *Phyllosticta cepae* n. sp., the subepidermal, erumpent, globose pycnidia of which measure 64·6 to 110·5 $\mu$ in diameter, with a depressed, circular ostiole, 8·5 to 16·5 $\mu$ in diameter; the smooth, black peridium is 6·8 to 13·5 $\mu$ thick; the smooth, elliptical to semi-ovoid, hyaline, continuous, biguttulate, mostly muticate pycnospores measure 3·4 to 7·1 by 1·7 to 2·2 $\mu$; and the conidiophores are short, hyaline, and simple.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW

OF

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VONDRÁK (J.) & NEUWIRTH (F.). **Inversion feucht gewordener Raffinade durch mikroskopische Pilze.** [The inversion of damp refined sugars by microscopic fungi.]—*Zeitschr. für Zuckerind.*, lvii, 3, pp. 17–21 ; 4, pp. 25–29, 4 figs., 1932.

An account is given of the extensive inversion under damp conditions of refined sugars (stated to be now frequent in Czecho-Slovakian factories owing to the economic necessity for prolonged storage) caused by three fungi, viz., *Penicillium crustaceum*, *Aspergillus glaucus*, and *Torula sacchari* [*R.A.M.*, x, p. 656]. Care should be taken to provide the storage rooms with adequate facilities for heating.

CIFERRI (R.) & HERTER (W. G.). **Ustilaginales uruguayenses ; itinera Herteriana IV.** [Uruguayan Ustilaginales ; Herter's itinerary IV.]—*Bot. Arch.*, xxxiv, 3–4, pp. 527–540, 1932.

A list is given of 35 Ustilaginales collected by the second-named author in Uruguay (and in a few cases also in Paraguay and Brazil), with critical and taxonomic notes by the first-named writer.

CHILD (MARION). **The genus Daldinia.**—*Ann. Missouri Bot. Gard.*, xix, 4, pp. 429–496, 8 pl., 1932.

Thirteen species of *Daldinia* (three new) are described with extensive taxonomic, geographical, and historical annotations, while a further ten are listed as doubtful or excluded. A key to the recognition of the species is given.

CHAMBERLAIN (E. E.). **Sclerotium disease (Sclerotinia sclerotiorum) of Tomatoes.**—*New Zealand Journ. of Agric.*, xlv, 5, pp. 260–268, 6 figs., 1932.

This is a brief morphological and biological account of the stalk rot of tomatoes caused by *Sclerotinia sclerotiorum* [*R.A.M.*, x, p. 494] which is stated to be one of the most serious diseases of the crop in New Zealand. A discussion is also given of the measures for its prevention and control.

RIPPEL (K.). **Über die Wirkung von Fungiziden auf Cladosporium fulvum Cooke und die Aussichten einer chemotherapeutischen Bekämpfung der Pilze. Zugleich ein Beitrag zu den Arbeitsmethoden der experimentellen Phytopathologie.** [On the action of fungicides on *Cladosporium fulvum* Cooke and the prospects of a chemotherapeutical control of fungi. Together with a contribution to the working methods of experimental phytopathology.]—*Arch. für Mikrobiol.*, iii, pp. 543–558, 1932.

The values obtained in laboratory tests on the reaction of fungus spores to fungicides are not directly applicable to practical control, since the toxicity of a given quantity of the disinfectant depends on the spore numbers. The more numerous the latter in contact with the fungicide, the more resistant are they. Besides the particular fungus to be tested, others should be used to provide a basis for comparison. For instance, the spores of the tomato leaf mould fungus, *Cladosporium fulvum* [*R.A.M.*, xi, p. 680], were found to be much more resistant to fungicidal action than those of the other organisms tested. In order to destroy the fungus it would be necessary to use the preparations at such high concentrations as must seriously injure the plants. No prospects of chemical control can, therefore, be entertained. A species of *Botrytis*, evidently new, was found parasitizing *C. fulvum.*

GROSSMANN (HELEN). **Das Ulmensterben.** [The die-back of Elms.]—Reprinted from *Schweiz. Zeitschr. für Forstwesen, 1932*, 9 pp., 2 pl., 1932.

An account is given of the distribution, symptoms, mode of infection, and control (direct, indirect, and biological) of the die-back of elms (*Ceratostomella ulmi*) [*R.A.M.*, x, p. 564]. Attention is drawn to the ravages of the disease in France, especially at Versailles, where the famous avenue leading to the Grand Trianon has had to be entirely replanted with lime trees, while 60 to 70 per cent. of the elms in the courtyard on the town side of the palace are reduced to mere stumps. In Switzerland the writer has only observed the die-back on cultivated elms in avenues and the like, those growing wild in the forest being apparently free from infection. The work of the Dutch and German authorities on the disease is briefly summarized.

LENDNER (A.). **La 'maladie des Ormes' à Genève.** [The Elm disease at Geneva.]—*Verhandl. Schweiz. Naturforsch. Gesellsch.*, cxiii, pp. 371–372, 1932.

Elm trees in the Geneva parks and public gardens, avenues, and the like are stated to be suffering from die-back [see preceding abstract] which is attributed by the writer primarily to *Micrococcus ulmi* [*R.A.M.*, viii, p. 343] and *Pseudomonas lignicola* Westerdijk [ibid., ix. p. 5], the effects of *Graphium* [*Ceratostomella*] *ulmi* being secondary. All these organisms, as well as the *Scolytus* beetles found in the bark, are confined to weakly trees growing in dry soils. No symptoms of die-back have been observed among trees planted near water. The chronic form of the disease is mostly in evidence.

LOOS (W.). **Über eine buchenholzbewohnende Ceratostomella, C. fagi nov. sp.** [On a Beech wood-inhabiting *Ceratostomella*, *C. fagi* nov. sp.]—*Arch. für Mikrobiol.*, iii, pp. 370–383, 6 figs., 1932. [Abs. in *Neuheiten auf dem Geb. des Pflanzensch.*, *1932*, 5–6, p. 121, 1932.]

*Ceratostomella fagi* n. sp. makes the best growth on beech wood, thriving also on spruce but developing very poorly on pine. The fungus causes [in Germany] a dark brown discoloration of beech wood and turns spruce brown and pine blue. The pine *Graphium* [*C. pini*] produces similar discolorations, whereas the action of *C. piceae* on the woods in question is negligible [cf. *R.A.M.*, xi, p. 616]. The new fungus is not a wood-destroyer but lives on the cell contents: it is sparing in its oxygen requirements and highly resistant to acids.

GÄUMANN (E.) & CAMPBELL (E.). **Über eine Kiefernkrankheit im Gebiete des Ofenberges.** [On a Pine disease in the Ofenberg region.]—Reprinted from *Schweiz. Zeitschr. für Forstwesen*, *1932*, 4 pp., 1 pl., 1932.

Pine trees in the Ofenberg region of Switzerland have been observed to show somewhat ill-defined symptoms of disease, such as a brown discoloration of single branches or twigs, curtailment of the current year's shoots, desiccation of the bark, and resin flow at the stem base. Affected trees die in three to four years. The coarse, snow-white mycelium below the cortex of the roots and especially at the collar at once suggested infection by *Agaricus melleus* [*Armillaria mellea*], a supposition that was confirmed by the isolation of the fungus in pure culture. Fruit bodies were not usually present in the natural stands, possibly on account of the exceptionally dry climate of the district under observation, to which also the somewhat atypical symptoms of the attack may probably be referred. The spread of the parasite is promoted to a certain extent by the systematic conservation of the affected pines under the 'nature protection' regulations of the forests comprising the national park. It has further been observed that the disease is much more severe in the pure pine stands of this region than in the natural mixed woodlands.

ANNAND (P. N.), CHAMBERLIN (J. C.), HENDERSON (C. F.), & WATERS (H. A.). **Movements of the Beet leaf hopper in 1930 in southern Idaho.**—*U.S. Dept. of Agric. Circ.* 244, 24 pp., 2 diags., 7 graphs, 2 maps, 1932.

The 1930 flight of beet leafhoppers (*Eutettix tenella*) was intensively studied in southern Idaho in 1930 in relation to the insect populations in the beet fields and consequent incidence of curly top [*R.A.M.*, xi, p. 419 and next abstract]. By 17th to 22nd June the leafhopper populations were extremely high in the sections concurrently showing a large percentage of curly top, and by 11th August leafhoppers had infested 90 to 95 per cent. of the crop of southern Idaho.

Twenty-one fields of Great Northern beans [*Phaseolus vulgaris*] were also inspected at regular intervals for curly top [ibid., xi, p. 556]. This plant is not a favourable host for the leafhopper, as

indicated by the fact that the numbers reached by 30th June were maintained but not increased throughout the season, while nymphs were very rare in the bean fields as late as 20th August. The curly top percentages rose steadily from 23rd June to 21st July, when a level was reached that was maintained for the rest of the season. The general movement of the insects was from the north-west and west.

**Leaf hopper control in California.**—*Facts about Sugar*, xxvii, 9, pp. 397–398, 2 figs., 1932.

The problem of beet leafhopper (*Eutettix tenella*) control [see preceding abstract] in California is claimed to have been solved by E. A. Schwing, entomologist to the Spreckels Sugar Company, who has organized a campaign with tractors to destroy the Russian thistles [*Salsola kali*: *R.A.M.*, vii, p. 137] constituting the favourite food of the insects, combined with the extensive use of an oil-pyrethrum spray. Many beet factories have been obliged to close down of recent years owing to the ravages of blight [curly top], the virus of which is disseminated by the leafhoppers, while tomatoes suffer from 'western yellows' [curly top] due to the same cause [ibid., xi, p. 210]. The cost of the campaign in 1931 was about $12,000, while the direct loss to beet growers on the 10,000 acres abandoned in 1925 on account of leafhopper infestation was $150,000.

COCHRAN (L. C.). **A study of two Septoria leaf spots of Celery.**—*Phytopath.*, xxii, 10, pp. 791–812, 4 figs., 1932.

This is an expanded account of the writer's investigations on the two forms of celery blight in the United States, viz., the small spot type caused by *Septoria apii-graveolentis* and the large spot due to *S. apii* [*R.A.M.*, x, p. 430]. The former is stated to be much the more common of the two in America. In pure culture *S. apii* made a spreading growth with a black submerged and white aerial mycelium, while the colonies of *S. apii-graveolentis* were more tufted and of a somewhat cheesy consistency. Potato dextrose agar was turned purple by *S. apii*. The spores of the small- and large-spot organisms were killed in ten minutes at 41° and 43° C., respectively, the optimum temperature for the growth of the former being 18° to 22° and for the latter 22° to 24°. None of the commercial varieties tested showed any evidence of resistance to these diseases, though the green ones are able to withstand their effects longer than the white.

LE CLERG (E. L.). **Leaf temperature of Lettuce and its relation to tipburn.**—*Phytopath.*, xxii, 10, pp. 851–855, 1932.

The results [which are tabulated and discussed] of determinations by means of thermocouples pressed against the surface and a Leeds and Northrup No. 2500–A galvanometer, of the leaf temperatures of lettuce in relation to tipburn in Colorado [*R.A.M.*, x, p. 439] showed that, in normal plants in sunlight, the leaf was always cooler than the air, the upper surface of the leaf bases being 2° C. and the lower surface 2·1° below air temperature. In diffuse light the reverse occurs, the upper surface of the base

being 1·6° and the lower 1·3° warmer than the air. The edge of healthy leaves was found to be 0·7° to 0·8° warmer than the leaf base both in sunlight and shade. Hourly temperature readings, made during the night on leaves in process of tipburning, indicated that the upper surface of the tip ranged from 0·5° to 11·8° lower than the air temperature. During the time of rapid development of tipburn (9.15 p.m. to 12 midnight) the range was from 0·5° to 3·1° below the surrounding air temperature. It is evident, therefore, that tipburn of lettuce is not caused by an excessive variation in the temperature of the leaf tissues as compared with that of the air.

DOIDGE (E[THEL] M.). **A wilt disease of Cucurbits.**—*Farming in South Africa*, vii, 79, pp. 299–300, 1 fig., 1932.

A brief, popular account is given of a wilt disease of marrows [*Cucurbita pepo*] and pumpkins [*C.* spp.] in the Pretoria district of South Africa, the causal organism of which was identified by Dr. Wollenweber as *Fusarium javanicum* var. *theobromae*, not hitherto reported on these hosts. Positive results were given by inoculation experiments on Long Bush marrows, Boer pumpkins, and Ice Cream watermelons, while White Spine cucumbers were fairly resistant. As a precautionary measure the seed should be immersed for 5 to 7 minutes in mercuric chloride (1 oz. in 7½ galls. water) or formalin (1 in 200).

PORTER (D. R.). **Some environmental relations of Watermelon wilt.**—*Phytopath.*, xxii, 10, pp. 813–825, 3 graphs, 1932.

Experiments conducted in Iowa in 1927 and 1928 indicated the existence of a positive correlation between air temperature and the rate of wilting in watermelons affected by *Fusarium niveum* [*R.A.M.*, xi, p. 558], and recent (1931) investigations with the Klondike variety in California confirmed the previous results. A further tendency was apparent for relatively rapid wilting to follow periods of relatively intense sunlight, as determined by the difference in the rate of evaporation between the black and white atmometer cells. The Californian tests showed that the rate of wilting increased with a decrease in the relative humidity of the air. The rate of evaporation as indicated by white atmometer cells, conditioned by air temperature and humidity, light intensity, and wind velocity, appears to influence the rate of wilting, an increase of which coincides with an augmented rate of evaporation, while a slow evaporation rate is accompanied by a relatively slow rate of wilting.

MONTET (D.). **L'action de l'oxyde noir d'urane en culture industrielle de champignons.** [The influence of black oxide of uranium in the commercial cultivation of Mushrooms.]—*Comptes rendus Soc. de Biol.*, cxi, 29, pp. 20–22, 1932.

The addition of black oxide of uranium ($U_2O_5$) at the rate of 0·2 to 1·5 gm. per kg. to the forcing-beds of edible mushrooms (*Psalliota campestris*) in northern France resulted in a considerable increase of yield (from 3·570 to 4·770 kg. fresh weight

per bed at 1 gm. per kg.). The incidence of 'môle' [*Mycogone perniciosa*: *R.A.M.*, xi, p. 493] was not affected by the treatment.

GENTY (P.). **Les Truffes de Bourgogne.** [The Truffles of Burgundy.]—*Bull. Soc. Bot. de France*, lxxix, 5–6, pp. 477–482, 1932.

The author states that, apart from the so-called 'false truffles' which have no gastronomic interest, he has established the natural occurrence in Burgundy of four species of true truffles, equal in quality to those of Périgord, namely: *Tuber melanosporum*, *T. brumale*, *T. aestivum*, and *T. uncinatum*. Of these the two first-named are most prized for culinary purposes. In size they vary from that of a walnut to that of a closed fist, and their peridium is covered with hexagonal, prismatic warts, but while *T. melanosporum* has a white flesh which at maturity turns a dark purplish-brown (almost black), and is only found under oaks, *T. brumale* has a white flesh which turns dark grey or brown at maturity, and occurs under various trees. Both are fairly frequent in Burgundy. The other two species are more common but less appreciated; they differ from each other chiefly in the time of the year when they reach maturity, and also in the shape of their spores.

DUFRÉNOY (J.). **Les facteurs écologiques de l'apparition des lésions de Plasmopara viticola sur la Vigne.** [The ecological factors in the development of the lesions of *Plasmopara viticola* on the Vine.]—*Comptes rendus Soc. de Biol.*, cxi, 30, pp. 187–188, 1932.

Observations during 1932 in various localities of south-eastern France showed that an attack of vine mildew (*Plasmopara viticola*) occurred in many places on 15th to 17th May as a result of primary infection at the end of the rainy spell from 28th April to 3rd May [cf. *R.A.M.*, xi, p. 623]. The mean temperature during the incubation period was 12·8° C. In another case primary infection took place on 15th to 17th May and the lesions developed after an incubation period of ten days at 15°. The attack developing from 4th to 7th June resulted from infection twelve days previously (13·5°) and the resulting zoospores provoked a further slight invasion after eight days (16°). Leaves infected towards the end of the period from 11th to 20th June developed spots from 24th to 27th June, while an attack from 3rd to 6th July followed invasion during the rains of 28th to 29th June (21°). Five days after infection on 4th to 5th June very severe symptoms developed on untreated vines, the mean temperature being 19·5°.

CADORET (A.). **La défense positive contre le mildiou en 1932.** [Effective control of mildew in 1932.]—*Prog. Agric. et Vitic.*, xcviii, 45, pp. 447–449, 1932.

The author states that experience in 1932 again confirmed the entire efficacy of the blue alkaline Bordeaux mixture recommended by him [*R.A.M.*, iii, p. 187; vii, p. 614], in the control of vine mildew [*Plasmopara viticola*], in every case where it was used. Extended inquiries in France and Algeria, and experiments at the

author's station showed that in vineyards sprayed with weak Bordeaux mixtures (1 and 2 per cent. copper sulphate) the losses caused by mildew ranged from 70 to 90 per cent. of the crop, while in vineyards sprayed with 3 per cent. Bordeaux mixture, they did not exceed 25 per cent., and they ranged only from 5 to 10 per cent. in those that were treated with a 4 per cent. mixture. At the two last-stated concentrations the mixture, when prepared with freshly slaked lime, is very adhesive by itself, and has never been known to cause scorching of the foliage.

MANZONI (L.). **Numero dei trattamenti antiperonosporici e concentrazione in rame delle poltiglie. Nota riguardante in modo speciale la provincia di Treviso.** [The number of anti-mildew treatments and the copper content of sprays. A note relating in particular to the province of Treviso.]—Reprinted from *Il Coltivatore e Giorn. Vinic. Ital., 1932*, 43, 8 pp., 1932.

After reviewing the reports issued from 1929 to 1932, inclusive, by the various stations established in the province of Treviso for forecasting attacks of vine mildew [*Plasmopara viticola*: *R.A.M.*, xii, p. 73], the author concludes that the number of spray applications required varies less than might be supposed from the different intensities with which infection develops. Even if the spring is fine and the locality not liable to severe outbreaks, the early spray applications should not be omitted, though the first one may be delayed until the oil spots appear. Dust applications with cupric sulphur should never be neglected, especially between the end of June and the beginning of August; if this period is wet they are essential.

In the author's opinion, the first spray applications, even in areas where the disease is dangerous, may quite safely be made with 0·5 to 0·7 per cent. Bordeaux mixture, though a concentration of 1 per cent. should be used for the final two.

Two commercial preparations of small copper content when tested against 1 per cent. Bordeaux mixture, five and six applications being made with each, gave eminently satisfactory results. One, 'minati' (G. Negroni, Treviso), consisted chiefly of ammonia and copper sulphate; it contained 6·25 per cent. copper, and was used at a concentration of 1 per cent., corresponding in copper content to 0·25 per cent. Bordeaux mixture. The other, the colloidal copper product, 'bouisol' (Società Industrie Chimiche, Rome) [ibid., xi, pp. 194, 396], contained about 12·5 per cent. copper, and was used at a concentration of 0·33 per cent. (even weaker concentrations were recommended by the manufacturers), roughly equivalent to 0·17 per cent. Bordeaux mixture. Bouisol was slightly the more efficacious of the two.

SERVEILLE (J.). **Encore l'alun.** [Alum again.]—*Prog. Agric. et Vitic.*, xcviii, 48, pp. 525–526, 1932.

In this brief note the author communicates a few observations made by him in 1932 which tend to show that alum, either alone or added to Bordeaux mixture, has a pronounced curative effect on vine mildew [*Plasmopara viticola*] both on the leaves and on the grape bunches [but cf. *R.A.M.*, xii, p. 139].

Ravaz (L.). **Le rougeau.** [Rougeau.]—*Prog. Agric. et Vitic.*, xcviii, 48, pp. 509–512, 1932.

The fact that during the autumn of 1931 the non-parasitic rougeau disease of the vine [*R.A.M.*, viii, p. 484] was much more prevalent and severe in France than in that of 1932 is attributed by the author in part to the heavy rainfall of the former year, and also to the effect of the mildew [*Plasmopara viticola*] epidemic of 1932, which, by destroying the foliage, forced the stocks to put out new shoots and thus prolonged their active vegetation late into the season.

Fairly numerous cases of rougeau were observed in 1932 in Algeria and Tunis, especially in vineyards situated on low-lying, water-retaining soils. In Tunis the variety Grenache is stated to be more susceptible to the trouble than the others grown locally.

Pollacci (G.). **Rassegna sull'attività del Laboratorio Crittogamico di Pavia (Osservatorio Fitopatologico per le provincie di Cremona, Parma, Pavia e Piacenza) durante l'anno 1931.** [Report on the activity of the Cryptogamic Laboratory of Pavia (Phytopathological Observatory for the provinces of Cremona, Parma, Pavia, and Piacenza) during the year 1931.]—*Atti Ist. Bot. R. Univ. di Pavia*, Ser. IV[a], iii, pp. 310–324, 1932.

This account of the work done at the Cryptogamic Laboratory, Pavia, during 1931 [cf. *R.A.M.*, xi, p. 281] includes various items of phytopathological interest, several of which have already been noticed from other sources; of the others the following may be cited. Die-back of elms (*Graphium* [*Ceratostomella*] *ulmi*) [ibid., xi, p. 810] is now prevalent in the provinces of Parma, Piacenza, and Cremona. Numerous species of elms are to be distributed to the local growers in order that resistance trials may be conducted. An apparently new vine disease has caused losses in the vicinity of Stradella and Voghera, and material has been collected and is to be studied. The cause has not yet been definitely ascertained, but root rot was present on over one hundred of the affected vines. Other records include *Alternaria brassicae* var. *exitiosa* [*A. brassicae* Bolle nec. Sacc.; ibid., iv, p. 61] on cabbage, white rust of lemons (*Rhynchodiplodia citri*), *Bacillus amylovorus* on pear branches, twigs, and leaves and on apple branches and twigs, and *A. brassicae* on melon leaves.

Simmonds (J. H.). **The work of the Pathological Branch.**—*Ann. Rept. Queensland Dept. of Agric. & Stock for the year 1931–1932*, pp. 56–57, 1932.

Notes are given on the investigations of various phytopathological problems in Queensland during the period under review (year ending 30th June 1932), among which the following may be mentioned. Isolated cases of cotton wilt (*Verticillium* sp.) have been reported, mainly involving only small areas. A disease resembling the blight caused by *Ascochyta gossypii* in the United States [*R.A.M.*, ix, p. 240] developed in the Boonah district. A comparative morphological study of the fungus isolated from diseased plants and *A. gossypii* is in progress.

Blue mould [*Peronospora* sp.: ibid., xi, p. 607] is considered to be the most serious obstacle to tobacco cultivation in Queensland, where it is of practically universal occurrence.

Investigations by [R. B.] Morwood of banana heart rot [ibid., xi, p. 157] indicated that this disease may be readily controlled by the usual measures directed towards the eradication of bunchy top.

Pink disease of citrus (*Corticium salmonicolor*) was very prevalent in some of the northern districts.

Apples showed a spotting of the fruits resembling that due to *Phoma* [*Mycosphaerella*] *pomi* [ibid., xi, p. 427], an organism similar to which was isolated from infected material.

Thread blight (? *Marasmius* sp.) was observed in young tung oil [*Aleurites fordii*] plantations in North Queensland.

WALLACE (G. B.). **Report of the Mycologist.**—*Ann. Rept. Dept. Agric. Tanganyika Territory 1931*, pp. 94–97, 1932.

A rot of sisal [*Agave rigida* var. *sisalana*] plants, characterized by a yellow discoloration and decay originating in the leaf-stumps where leaves have been harvested in the wet season, has been investigated. The rot passes into the main stump which softens and turns black in the interior. Infection in one block of 4 hect. amounted to 5 per cent. The trouble is believed to be due to a deficiency of some essential plant food in the soil. A similar disturbance has been observed in young sisal transplants, apparently resulting from water deficiency or injury at the time of planting out, caused by the separation of the suckers from the parent rhizome.

*Rhizoctonia bataticola* [*Macrophomina phaseoli*] was twice found to be the cause of a root disease of tea, and occurred also on roots of *Cassia floribunda* growing as a shade tree in the plantations. A serious disease, believed to be of physiological origin and closely resembling one [? yellows] reported from Nyasaland [ibid., xi, p. 805], has been observed in the Iringa Province.

Tobacco is commonly attacked by white mould (*Erysiphe cichoracearum*) and frog-eye spot (*Cercospora nicotianae*) [ibid., xi, p. 677].

Coffee in the Usambara Mountains is liable to severe infection by *Armillaria mellea* [ibid., ix, p. 32], apparently a different strain from that attacking *Grevillea robusta* [ibid., xii, p. 142].

Ear rots of maize (*Gibberella moniliformis* and *G. saubinetii*) are prevalent, while other fungi infecting this crop include *Diplodia macrospora* and *D. zeae* [ibid., x, p. 238], causing a white decay of the ears, and *Nigrospora sphaerica*.

Cape gooseberries (*Physalis peruviana*) were severely damaged at Morogoro during July and August by white smut (*Entyloma physalidis*). *M. phaseoli* was responsible for heavy damping-off of citrus seedlings [ibid., ix, p. 628], and also occurred on *Dolichos lablab*, apparently in a parasitic form.

DEIGHTON (F. C.). **Mycological work.**—*Ann. Rept. Agric. Dept. Sierra Leone for the year 1931*, pp. 20–25, 1932.

During the period under review, Canary bananas [*Musa cavendishii*] in Sierra Leone became affected by a fruit spot prevalent in

wet seasons and associated with a *Pestalozzia* [cf. *R.A.M.*, xi, p. 190], the fruit when half ripe showing circular, water-soaked areas up to 2 mm. in diameter with a central spot which later developed into a dark sunken area with a narrow, water-soaked margin. Several dark areas sometimes coalesced. As the fruit matured, the small spots lengthened out into transverse streaks and the larger black areas into longitudinal cracks with grey margins.

Two apparently distinct types of *Gloeosporium* attack were observed on cassava. The die-back previously reported [ibid., xi, p. 97] affected nearly all the plants on a one-acre plot of the Mayugbe variety and a year later caused at least 20 and occasionally 100 per cent. defoliation. The Kanda and Sessile Leaf varieties showed grey lesions round the base of some of the upper leaves and for half an inch along the main stem below the node; later, the lesions spread above the node and the affected leaves wilted and died. Occasionally, the tip of the shoot wilted.

Most cassava varieties were affected to different degrees by mosaic [ibid., xi, p. 761], but spread was very slow, one of some Mende-lange plants set in July 1928, with the leaves in contact with affected cassava, becoming affected in October and the remainder still being healthy in the following May. In that month, about twenty healthy Mende-lange plants were set in beds adjacent to one containing affected cassava of the same variety; two became diseased the following November, and by the end of 1931 about one-third had contracted mosaic, one plant not becoming affected until late in the same year. Out of thirteen healthy plants of different varieties inoculated in November (by replacing a narrow strip of tissues down to the wood of the stem of a healthy plant by tissues from the internode of a mosaic plant) three in December produced mosaic shoots just below the graft.

Scab [*Sporotrichum citri*: ibid., xii, p. 166] is the chief disease of citrus in Sierra Leone, infection becoming abundant on the young leaves during the rainy season and afterwards decreasing; leaves produced in January frequently become slightly scabbed. In one nursery rough lemon [*Citrus limonia*] was badly attacked, grapefruit rather badly, Tahiti lime [*C. aurantifolia* var.: ibid., x, p. 786], sour orange [*C. aurantium* var. *bigaradia*], and Genoa lemon moderately, and tangerine [*C. nobilis* var. *deliciosa*] slightly; sweet orange [*C. sinensis*], shaddock [*C. decumana*], lime [*C. aurantifolia*], and sweet lime [*C. medica*] were unaffected.

Liberian coffee was attacked by a *Cephaleuros* causing canker-like, stem-girdling lesions.

Periwinkle (*Lochnera* [*Vinca*] *rosea*) was affected by a rosette apparently belonging to the virus group of diseases; the attack spread to neighbouring plants, but seedlings near an affected plant remained healthy.

*Sesamum radiatum* in Sierra Leone is commonly attacked by chlorosis, the plants apparently becoming affected after passing the seedling stage. Slightly affected leaves are mottled, the part along the veins being yellow, while the leaves on severely diseased shoots are yellow, and are often curled and dwarfed, with turned-up edges. Badly chlorosed leaves bear enations, frequently seen

as minute foliar structures, on the lower surface, generally over the net veins, but often over the primary branch veins or midrib. Diseased plants are stunted and do not flower. The disease appears to belong to the virus group.

*Monilochaetes infuscans* was found on sweet potatoes [cf. ibid., x, p. 403].

A strain of *Rhizoctonia* [*Corticium*] *solani* with large sclerotia was found on maize (apparently causing the same disease as that reported from Ceylon) [ibid., vi, p. 286] and pigeon pea. Maize was also attacked by *Sclerotium rolfsii*, which also causes a leaf spot of *Luffa cylindrica* [*L. aegyptiaca*].

Other new records include *Cercospora stizolobii* on Bengal bean (*Mucuna pruriens*), *C. melongenae* on eggplant, *C. duddiae* on onion and native shallot, and *Myriogenospora paspali* on *Paspalum scrobiculatum*.

**Fifth Biennial Report Michigan Department of Agriculture for the fiscal years ending June 30, 1931 and 1932.**—149 pp., 7 figs., 3 maps, 1932.

The following items of phytopathological interest occur in this report. The 1931 crop report for Michigan shows that the average wheat yield per acre was 26 bushels, the highest on record, the loss from black stem rust [*Puccinia graminis*] being less than half of 1 per cent. As the campaign for barberry eradication progresses, the number and severity of stem rust epidemics is gradually diminishing. According to the figures supplied by the Division of Barberry Eradication of the United States Department of Agriculture, the average annual loss of wheat from *P. graminis* was 57,704,000 bushels from 1916 to 1920; 17,867,000 bushels from 1921 to 1925; and 9,609,000 bushels from 1926 to 1930. During 1931 and 1932, 80,014 barberry bushes were eradicated in Michigan [*R.A.M.*, x, p. 364].

The 'red suture' disease of peaches is gaining ground in the State [ibid., xi, p. 789], the number of affected trees marked on 2,646 farms in 1931 being 1,434 as against 7 on 1,841 farms in 1930. The corresponding figures for yellows were 2,935 in 1931 (1,006 in 1930) and for little peach 18,675 (4,867).

Since 1928 the systematic removal of cultivated black currants from all counties with white pine [*Pinus strobus*] stands, against blister rust [*Cronartium ribicola*], has been in progress [ibid., x, p. 364]. The total number of bushes eradicated up to 30th June 1932 was 894,003 in the Upper Peninsula and 533,909 in the Lower Peninsula.

**Division of Botany.**—*Fifty-first Ann. Rept. New York (Geneva) Agric. Exper. Stat. for the fiscal year ended June 30, 1932*, pp. 31–43, 1932.

The following items of phytopathological interest, besides others already noticed from different sources, occur in this report. The necrotic effect of red mosaic on new canes of susceptible black raspberry [*Rubus occidentalis*] varieties [*R.A.M.*, x, p. 164 and next abstract] appears from the current year's observations to be correlated with cool weather rather than with growth changes as

influenced by the supply of soil moisture. The permanence of the injury depends on the degree to which the tip is affected. Resistant varieties show only a slight arrest of growth, often amounting to no more than one or two dwarfed and mottled leaves with blue-spotted petioles. In such cases the slow, insidious reduction of vigour presents a strong contrast to the rapid decline of susceptible varieties in which the growing tips are severely damaged. The Naples variety shows a marked capacity to withstand infection by red mosaic, but when the disease is contracted the symptoms are very pronounced. In a three-year-old planting the Naples stock showed a red mosaic incidence of one-tenth of that of an adjacent susceptible seedling. The Newburgh variety maintains a high record of resistance both to red and yellow mosaic.

A mosaic-like disease of strawberries [cf. ibid., xi, p. 252] is prevalent in central and western New York, and was found during the period under review in a number of Premier plantings causing 10 to 25 per cent. infection. All the runners from a diseased mother plant are affected, dwarfing and mottling of the early foliage being very conspicuous. Among the most susceptible varieties with Superb as one parent are Waite's Perfection, Aldrich, and Haverland. Rapid degeneration is a feature of the disease in the susceptible types of strawberry.

Refugee beans [*Phaseolus vulgaris*] continued to suffer severely from mosaic [ibid., xi, pp. 499, 561], promising results in the control of which have been given by roguing.

Spraying experiments against apple scab [*Venturia inaequalis*] in a Ben Davis orchard [ibid., xi, p. 788] indicated that summer applications of lime-sulphur may sometimes cause more foliage injury than the fungus [cf. ibid., xii, p. 30]. During the past three years the delayed dormant spray, given at the proper times, was the most effective of all applications.

**Forty-second Annual Report Washington Department of Agriculture for the fiscal year ended June 30, 1932.**—*Washington Agric. Exper. Stat. Bull.* 275, 84 pp., 1932.

The following are some of the items of phytopathological interest in this report, in addition to those already noticed from other sources. F. D. Heald, E. F. Gaines, C. S. Holton, and A. M. Schlehuber identified ten physiologic forms of *Tilletia tritici* [*T. caries*] and twelve of *T. levis* [*T. foetens*: *R.A.M.*, xii, p. 156]. Nearly 2,000 varieties and hybrid selections of winter wheat were analysed for relative resistance to one or more of nine of these physiologic forms. Infection ranging from 75 to 100 per cent. was obtained on susceptible varieties, whereas 98 resistant sorts remained free from all the nine forms. More than 300 spring wheats, mostly $F_5$ and $F_6$ segregates, were also tested for bunt resistance, the inoculum being a composite sample of 20 collections comprising all the physiologic forms available at the Station. The 11 check rows of Jenkin averaged 70 per cent. of bunted heads, while 68 of the fixed hybrids remained healthy. Of 17 oat varieties tested for resistance to covered smut [*Ustilago kolleri*: ibid., xi, p. 498], Markton was the only one to remain immune.

L. K. Jones found that the annual increase of mosaic [see pre-

ceding abstract] in the Cuthbert red raspberry amounts to some 20 per cent., while the rate of spread from red to black raspberries [*Rubus occidentalis*] is considerably more rapid. Thus, in one year the incidence of infection in a Cumberland black raspberry planting adjacent to red raspberries rose from 5 to 80 per cent. [ibid., xi, p. 381].

Cranberry bogs were severely infected during the past two years by *Sclerotinia oxycocci* [ibid., xi, p. 188], which was well controlled in D. J. Crowley's experiments by spraying with 3 per cent. lime-sulphur.

E. L. Overholser, L. L. Claypool, and F. L. Overley observed that little leaf or rosette of apple, peach, and cherry trees occurs mainly in orchards without a permanent lucerne cover crop, or where corrals for livestock were formerly situated. In no case was the disease found in orchards having a good uniform lucerne stand during the preceding three years. As in California, the injection of zinc sulphate into the base of the trunk in the late winter brings about marked recovery by midsummer [ibid., xii, p. 99].

Recent investigations have shown that the latent and vein-banding viruses of potato retain their virulence in dried plant tissues much longer than is generally believed. When combined with tobacco mosaic in tomato plants the latent virus retains its virulence for a year or more longer than when dried as a single virus [ibid., xi, p. 595].

The following are new records for the State: cane canker of roses (*Coniothyrium wernsdorffiae*) [ibid., ix, p. 721], rose bloom of azaleas (*Exobasidium azaleae*) [*E. vaccinii*: ibid., ix, p. 389], scab (*Venturia crataegi*) of red thorn (*Pyracantha coccinea*), leaf spot of peony (*Septoria paeoniae*) [ibid., iii, p. 138], and chestnut blight (*Endothia parasitica*).

**Forty-fourth Annual Report of the Kentucky Agricultural Experiment Station for the year 1931.**—Part I, 66 pp., 1932.

The following items of phytopathological interest occur in this report (pp. 19–22). Five mosaic tobacco plants were found among a total of some 66,600 on the Experiment Station farm three weeks after setting. By harvest time about 1 per cent. of the plants had become affected. This is the sixth consecutive year in which the disease has been almost prevented during the early part of the season by prohibiting the use of barn-cured tobacco by the men engaged in pulling and setting plants [*R.A.M.*, ix, p. 21]. Speck spot of Burley tobacco (small, circular, light brown spots) was found to be due to infection by any one of several viruses, e.g., the typical tobacco mosaics, etch, veinbanding, and cucumber mosaic [ibid., xi, pp. 334, 406, *et passim*]. As indicated by previous investigations, frenching of tobacco may apparently be due to a deficiency of nitrogen, phosphorus, or potassium in the soil [ibid., xi, p. 807]. It has not been found in soils containing large amounts of basic calcium.

Studies are in progress on a virus disease of plums which appears to cause a gradual loss of vigour and eventual death of the trees [see below, p. 230]. It has been transferred to seedling

peaches from the Abundance, Red June, October Purple, Bovay, and Shiro plum varieties. The leaves of orchard trees of the three first-named varieties showed distinct leaf patterns of the ring-spot type. The disease was found on Abundance in a nursery, where a few very typical ring-spot patterns were also detected on the foliage of Elberta peaches.

**Forty-fourth Annual Report of the Indiana Agricultural Experiment Station for the year ending June 30, 1931.**—87 pp., 17 figs., 1 graph, 1931. [Received November, 1932.]

The following items of phytopathological interest, in addition to those already noticed from other sources, occur in this report. Complete control of tomato leaf spot (*Septoria lycopersici*) was given by the application of Bordeaux mixture at ten-day intervals throughout the growing season, a copper-lime dust given at the same times being only partially effective [*R.A.M.*, v, p. 393]. Spraying caused a marked delay, however, in the maturation of the fruits, resulting in a considerable reduction of yield. It was experimentally shown that tomato foliage must be wet with dew or rain continuously for at least 30 hours before extensive infection by *S. lycopersici* will take place. A high degree of resistance to wilt (*Fusarium*) [*lycopersici*] was shown by the Indiana Baltimore variety.

The tomato mosaic virus [ibid., xii, p. 79] has shown a tendency to induce necrosis on a number of hosts, the effects being particularly noticeable on the Dwarf California Giant petunia, certain flowering species of *Nicotiana*, viz., *N. affinis*, *N. sylvestris*, and *N. sanderae*, and *Salpiglossis sinuata*. The first- and last-named are generally killed outright by inoculation with the virus, while the *Nicotiana* plants develop extensive dead areas on the leaves, and girdling the stem, causing the death of the upper parts.

In comparative trials of commercial strains of Golden Bantam maize and some hybrid selections resistant to bacterial wilt [*Aplanobacter stewarti*: ibid., xii, p. 78], the former showed an average of 10·7 per cent. wilt with 8·2 per cent. loss from sterility while the corresponding figures for the latter were only 0·5 and 0·3 per cent., respectively.

Selections with a high degree of resistance to leaf rust [*Puccinia triticina*] have been found among such standard soft red winter wheats as Fultz and Michigan Amber. In a further study of the effect of nutrition on the reaction of wheat to leaf rust it was found that a moderate supply of nitrogen to soils deficient in this element produced a large increase in both rust and yield; when twice the amount was given, a further increase was observed in the incidence of rust while the yield remained almost the same. Potassium combined with nitrogen resulted in a relatively high yield and a marked decline in the amount of rust. Potassium or phosphorus applied to a soil deficient in these elements resulted in an increased yield without augmenting the amount of rust.

Sooty blotch [*Gloeodes pomigena*: ibid., xi, p. 657] has been produced on young apples in a cool moist chamber by spore inoculations from cultures from twigs of *Asimina triloba*, *Xanthoxylum americanum*, *Crataegus mollis*, *C. crus-galli*, ash (*Fraxinus*

*americana*), plane (*Platanus occidentalis*), *Benzoin aestivale*, and *Vitis cordifolia*.

European strains of red clover [*Trifolium pratense*] have been found more resistant to mildew [*Erysiphe polygoni*: ibid., xii, p. 78] than those from the United States. Two physiologic forms of the fungus have been differentiated, of which 1 is the more prevalent while 2 has the wider host range. The mildew occurring naturally on alsike [*T. hybridum*] corresponds to form 1.

Van Hall (C. J. J.). **Cacao.**—Second edition, xviii + 514 pp., 151 figs., 14 diags., 2 graphs, 10 maps, London, Macmillan & Co., Ltd., 1932.

Chapter IX of the revised edition of this well-known work, first published in 1914, contains a discussion of the following diseases: collar crack (*Armillaria mellea*) [*R.A.M.*, x, p. 81], black root (*Rosellinia pepo*) [ibid., xi, p. 698], white, brown, and red root rots (*Fomes lignosus*, *F. lamaoensis*, and *Ganoderma pseudoferreum*), collar rot (*Ustulina zonata*) [ibid., vii, p. 565], *Sphaerostilbe repens* [ibid., ix, p. 20], canker and pod rot (*Phytophthora palmivora*) [ibid., xi, p. 703], bark rot and black spot (*Sphaeronema*) [ibid., iv, pp. 149, 529], the Surinam die-back disease [ibid., vi, p. 603], die-back and pod rot (*Diplodia* [*Botryodiplodia*] *theobromae*) [ibid., xi, p. 698], pink disease (*Corticium salmonicolor*), thread blights (*C. stevensii*, *Marasmius scandens* [ibid., x, p. 80], *M. byssicola* [ibid., vii, p. 565], and *M.* spp.), South American witches' broom (*M. perniciosus*) [ibid., xi, p. 703], Cameroon witches' broom disease (*Taphrina bussei*), and red rust (*Cephaleuros mycoidea*) [ibid., ix, p. 632].

Bunting (R. H.). **Actinomyces in Cacao-beans.**—*Ann. of Appl. Biol.*, xix, 4, pp. 515–517, 1932.

Examination of cacao beans imported from Nigeria into Amsterdam, which were affected by an objectionable, musty smell, showed the presence in them, among several other organisms, of three strains of *Actinomyces* [cf. *R.A.M.*, vii, p. 22] which cultural studies on several media proved to be responsible for the pungent odour. The percentage of the affected beans in the sample was not high, and the trouble is stated not to be of common occurrence in Nigerian cacao.

The paper includes the description by Waksman (to whom the organisms were submitted for identification) of the morphology, cultural characteristics, and biochemical properties of the three strains of *Actinomyces*; they are considered to be strains of a single species new to science, which is named *A. cacaoi* Waksman.

Garbowski (L.). **Współczesny stan badań nad rdzami Zbożowemi. (Referat zbiorowy).** [The present state of the investigations of cereal rusts. (Compilatory report).]—*Prace Wydz. Chorób Roślin Państw. Inst. Naukow. Gospod. Wiejsk. w Bydgoszczy* [*Trans. Phytopath. Sect. State Inst. Agric. Sci. in Bydgoszcz*] 12, pp. 25–88, 1932.

In this paper the author gives a very comprehensive review of

the recent literature [112 titles of which are quoted in the bibliography appended] dealing with cereal rusts [*Puccinia* spp.] throughout the world. Particular attention is given to the views expressed in regard to the specialization of the rusts, and to the geographical distribution and transmigration of biological forms; and there is a discussion of the ecological conditions that favour the development of the fungi and infection of the hosts. In the two final sections the problems of resistance and immunity, and of the control of the rusts by chemical means are dealt with at some length. Most of the information given has been noticed in this *Review* from time to time.

JOHNSON (T.), NEWTON (MARGARET), & BROWN (A. M.). **Hybridization of Puccinia graminis tritici with Puccinia graminis secalis and Puccinia graminis agrostidis.**—*Scient. Agric.*, xiii, 3, pp. 141–153, 1 pl., 1 fig., 2 diags., 1932. [French summary on p. 198.]

This is a detailed account of the authors' experiments [some of which have already been noticed: *R.A.M.*, x, p. 365] on crossings between *Puccinia graminis tritici* forms 30 and 95 and *P. g. secalis*. The four hybrid physiologic forms, 70, 104, 111, and 112, which were isolated from the $F_1$ generation of these crosses, proved to be low in virulence on the majority of wheat varieties tested and on rye, but their virulence to barley was about the same as that of the parent forms. Efforts to germinate their teleutospores in order to study segregation in the selfed progeny have hitherto failed.

Attempts to cross *P. g. tritici* and *P. g. agrostidis* gave negative results, except in one case, in which a haploid *P. g. tritici* pustule on barberry, to which nectar of *P. g. agrostidis* was applied, formed hybrid aecidia. The rust strain produced by these aecidia was very similar in its pathogenic properties to that of the *P. g. tritici* × *P. g. secalis* form 111, but even less virulent to wheat; barley varieties (*P. g. agrostidis* is unable to attack *Hordeum*) were either resistant or moderately susceptible to this hybrid, while *Agrostis alba* was moderately resistant.

The results of the whole work lead the authors to believe that hybrid forms of the type described may be expected to occur frequently in crosses of *P. g. tritici* with other varieties of this species.

HUBERT (K.). **Beiträge zur Züchtung rostresistenter Weizen.** [Contributions to the breeding of rust-resistant Wheats.]—*Zeitschr. für Züchtung*, A, xviii, 1, pp. 19–52, 1932.

The writer has continued the studies of Rudorf and Isenbeck [*R.A.M.*, ix, pp. 99, 514] on breeding wheat for resistance to yellow rust (*Puccinia glumarum tritici*), at the Halle Agricultural and Plant Breeding Institute, where attention was also directed to the inheritance of resistance to *P. triticina* [cf. ibid., xi, p. 564].

Greenhouse inoculation experiments were carried out with *P. glumarum* (chiefly form 2) on 100,910 plants of the progenies resulting from crosses between resistant and susceptible wheat varieties, and on 32,979 control plants (susceptible parents and

Hörning's or Krafft's Dickkopf). It was found that in crosses between the 'immune' variety Chinese 166 [ibid., xi, p. 666] or the highly resistant Chinese 165 and the very susceptible Ackermann's Bayernkönig (winter wheats), resistance to yellow rust is inherited as a dominant character. Owing to the complexity of the segregation ratios it has hitherto proved impossible to analyse the factors determining the mode of inheritance of this character, but the dominance of resistance is evidently incomplete. In the case of crosses between the highly resistant summer varieties Blausamtiger Kolben [Blue Velvet Club], Normandie, or Saumur and the very susceptible Peragis or Quax, resistance to *P. glumarum* is transmitted as a monomerous recessive character. Resistance to *P. triticina* form 15 is inherited as a monomerous dominant character in crosses between Blue Velvet Club or Normandy and Peragis. Among the $F_3$ progeny of the cross Blue Velvet Club and Peragis were certain individuals combining a high degree of resistance to both yellow and brown rust. In some of the progenies of crosses between resistant and susceptible varieties, resistance to *P. glumarum* has been maintained for four or five generations.

ZADE (A.). **Neue Untersuchungen über den latenten Pilzbefall und seinen Einfluss auf die Kulturpflanzen.** [New investigations on latent fungous infection and its influence on cultivated plants.]—*Fortschr. der Landw.*, vii, 21, pp. 529–532, 8 figs., 1932.

Continuing his investigations at Leipzig on the influence of the latent non-sporing type of fungous infection on cereals [*R.A.M.*, x, p. 717], the writer confirmed previous results with regard to the injurious effects of this form of attack in wheat invaded by *Tilletia tritici* [*T. caries*] and the following winter barley varieties by *Helminthosporium gramineum*: Almerfeld, Groningen, Friedrichswerth, Bürckner's, Werther's, Janetzki's, Streng's, Kalkreuth Universal, Engelen's medium-early, and Eckendorf Mammoth. The microscopic examination of sections through the lowest leaf node of wheat plants infected by *T. caries*, oats by *Ustilago avenae*, and barley by *H. gramineum* clearly revealed the hyphae of the various fungi. The external symptoms of this type of infection include the shortening of the haulms and ears, general weakness of the plants, and liability to winter injury.

On the basis of the results recorded, sporulation should not be regarded as the exclusive criterion of varietal immunity or fungicidal efficacy.

MILAN (A.). **Sul grado di accestimento delle piante di Grano colpite dalla 'carie'.** [On the amount of tillering of bunted Wheat plants.]—*Nuovo Giorn. Bot. Ital.*, N.S., xxxix, 3, pp. 603–612, 1932.

The [tabulated] results of eight years' experiments in which wheat of different varieties was inoculated with bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*: *R.A.M.*, xi, pp. 630, 631] either by being wounded or grown in artificially infected soil showed that severely affected plants tillered much less than

healthy or partly affected ones, but that there was little difference in this respect between the two last-named groups; thus, in one test, the average numbers of culms on healthy, partly diseased, and severely diseased plants were, respectively, 10·2, 9·5, and 7·4, the corresponding figures in two other tests being 8·4, 8, and 3·7; and 6·5, 6·2, and 3·2.

BUSSE (G.). **Pflanzenkrankheiten—Fruchtfolge—Düngung und Sortenfrage des Weizens.** [Plant diseases—crop rotation—manuring and the varietal problem of Wheat.]—*Deutsche Landw. Presse*, lix, 46, p. 579, 1932.

Replying to a number of correspondents on various subjects arising out of his recent paper on crop rotation and manuring [especially against *Ophiobolus graminis* on wheat: *R.A.M.*, xii, p. 19], the writer advises the cultivation of wheat following potatoes, fodder or sugar beets, lucerne, beans, vetch, oil seeds, or fallow (the two last-named being of little importance in the present-day system). In no case should wheat follow wheat or barley, and it should only succeed peas if the latter have been healthy and if the soil reaction is neutral; in most cases the application of lime is necessary. Oats may precede wheat if the field is manured between the two crops.

MEYER-BAHLBURG [W.]. **Ursachen des besonders starken Halmtöterbefalls.** [Causes of the particularly severe strawbreaker infection.]—*Deutsche Landw. Presse*, lix, 47, p. 588; 48, p. 603, 1932.

The writer discusses the various soil and cultural factors contributing to the severe epidemic of the 'strawbreaker' of wheat (*Ophiobolus*) [*herpotrichus*: *R.A.M.*, xii, p. 158] in northern Germany in 1932, including the light soils of the wheat-growing districts, shallow sowing, and faulty crop rotation. The last-named should be arranged as follows: fallow, wheat, beets, oats and clover, clover-grass, wheat, beets, and barley.

WANG (Mlle D. T.). **Observations cytologiques sur l'Ustilago hordei (Pers.) Kell. et Sw.** [Cytological observations on *Ustilago hordei* (Pers.) Kell. et Sw.]—*Comptes rendus Acad. des Sciences*, cxcv, 22, pp. 1041–1044, 1932.

The writer studied the cytology of *Ustilago hordei* [*R.A.M.*, vii, p. 532] in Van Tieghem cells on 2 per cent. beer wort at room temperature (17° to 20° C.).

The first division of the double nucleus is invariably the reduction division, the diploid number of chromosomes being four and the haploid two. Nuclear division is always effected by typical mitosis.

The promycelium usually divides into three uni- rarely binucleate cells, and a basal one, continuous with the spore, united by clamp-connexions. The sporidia develop near the septa of the promycelium and are uninucleate; they multiply at first by budding and then give rise to a more or less extensively branched mycelium. Intersporidial anastomoses were observed, the nucleus passing from one cell to another.

In a solid medium of 5 per cent. beer wort with 1·5 per cent. agar a white mycelium developed in 10 to 15 days. By the end of three months the cultures had assumed a yellowish to brownish tinge, and some of the hyphae became swollen, the swollen part containing one or two nuclei. These nucleate portions became shortened, rounded, and developed a thickened membrane, their behaviour thus corresponding exactly to that of the natural chlamydospores; they are, however, paler than the latter. The fusion of the two nuclei in each cell is believed to represent a true sexual process.

WELSH (J. N.). **The effect of smut on rust development and plant vigour in Oats.**—*Scient. Agric.*, xiii, 3, pp. 154–164, 1 fig., 1932. [French summary on p. 198.]

The results of field and greenhouse experiments reported in this paper showed that, in the four oat varieties tested, infection with covered and loose smut (*Ustilago levis* [*U. kolleri*] and *U. avenae*, respectively) led to a heavier development on the plants of crown rust (*Puccinia coronata avenae*) [*P. lolii*]. The smuts increased the ratio of immature to mature tillers in the oat plants and, particularly *U. kolleri*, reduced the height and tended to decrease the tillering capacity of the plants; the latter was lowest in plants in which all the panicles were smutted, while those that were partially smutted exhibited as many, and occasionally more, tillers than normal. Tillers with smutted panicles were more heavily rusted than those from the same plants bearing non-smutted panicles, but the latter had more rust than entirely smut-free plants. Oat plants apparently harbouring the mycelium of the smuts, but showing no evidence of smutted panicles, were intermediate in stage of maturity, height, and yield between those obviously smutted and plants raised from uninoculated seed-grain. Even on the immature tillers the rust was more severe in smutted than in smut-free plants, so that the effect of smut in increasing the proportion of immature parts is not sufficient to account for the increase in susceptibility.

MUSKETT (A. E.) & CAIRNS (H.). **The effect of seed disinfection upon the Oat crop in Northern Ireland.**—*Ann. of Appl. Biol.*, xix, 4, pp. 462–474, 1932.

The results of three years' experiments in Northern Ireland showed that 1 in 320 formaldehyde solution (used either as a steep or a sprinkle) gave the best control of covered and loose smuts (*Ustilago kolleri* and *U. avenae*) of oats, closely followed by ceresan and abavit B. In the field the two last-named compounds proved more satisfactory than formaldehyde in that the crop raised from seed grain dusted with either of them (at the rate of 3 oz. per bushel) on the average yielded about 30 per cent. more than the formaldehyde plots. It is believed that their greater efficiency is due to the fact that they are retained by the grain at the time of sowing, and remain operative during the early stages of the development of the seedlings. They have the further advantage over formaldehyde that the grain may be treated with them well

in advance of the time of sowing, without any injury to the crop. No cases of poisoning were observed to result from their use.

Sprinkling the seed-grain with copper sulphate or dusting it with copper carbonate caused definite injury to the crop, while sulphur or gypsum, used as dusts, had no fungicidal value.

Luthra (J. C.). **India: some fungal diseases of farm crops recently discovered in the Punjab.**—*Internat. Bull. of Plant Protect.*, vi, 11, pp. 181–182, 1932.

*Colletotrichum graminicolum*, the causal organism of red leaf spot of sorghum [*R.A.M.*, v, p. 656], has been found to be carried on the seed.

Fawcett (H. S.). **Citrus brown rot control.**—*California Citrograph*, xviii, 1, pp. 3, 31, 1932.

The citrus brown rot fungus (*Phytophthora citrophthora*), recently found for the first time in Florida and Louisiana [*R.A.M.*, xi, p. 779], produces germ-tubes in films of water which penetrate the rind of the fruit and set up brown rot a few days later. It also attacks some of the lower leaves, which it causes to drop. As far as is known, no new spores are formed on the fruits or leaves unless films of water are present. Once the affected surfaces are dry they cease to be a source of spread, so that new infections must then await another rainy period, which will furnish conditions in which viable spores will be splashed from the soil or flipped from a wet leaf to a fruit. In California, this species as well as the other brown-rot fungi *P. parasitica* [see next abstract] and *P. hibernalis* attack the fruit in the same manner. The last-named, however, requires cold weather (about 50° F.), as in Western Australia; it attacks orange leaves readily, and frequently causes heavy defoliation near the soil, or higher if it attacks after winds accompanying or just following rain. Notes are given on control by the Californian method [ibid., viii, p. 640; xi, p. 779].

Toxopeus (H. J.). **Nadere gegevens over de gomziekte in Djeroek manis (Citrus sinensis Osb.) en haar bestrijding.** [Further data on the gum disease of Djeroek manis (*Citrus sinensis* Osb.) and its control.]—*Meded. Inst. voor Plantenziekten* 80, 27 pp., 1 diag., 2 graphs, 1 map, 1932. [English summary.]

From 1929 to 1931 numerous experimental observations were made in connexion with the control of gummosis of sweet oranges (*Phytophthora parasitica*) in Java [*R.A.M.*, ix, p. 647].

It has been found that the incidence of infection may be greatly reduced by keeping the stem base and the surrounding soil dry. Trees up to about five years old are not so liable to infection as older ones, the reason probably being that they cast no shadow round the stem base and the fungus consequently succumbs to the high soil temperatures. Between the age of five and ten years attacks of gummosis are liable to be very severe, the stems being sufficiently slender to be ringed by one or two large lesions. The more extensive development of *P. parasitica* on the 'pelataran' (the trampled portion of the garden surrounding the house) is

attributed to the greater water-holding capacity and lower temperature of the uppermost soil layer in such places, while after rain large pools are formed in which sporangia and zoospores are produced in abundance. No difference was observed in the incidence of the gum disease in irrigated and non-irrigated gardens. Irrigation in the dry season at infrequent intervals is apparently inadequate to prevent the inhibition of growth of the fungus by high temperatures and drought, and the spread of infection on the tree is also much retarded in the dry monsoon. Tables are given showing the different amounts of infection on trees of varying diameter in seven villages.

Curative treatment consists in the excision of the diseased bark together with a surrounding strip of 1 cm. of the sound cortex, and covering the wound with a layer of paraffin mixed with carbolineum plantarium [ibid., x, p. 557]. The trees should be inspected monthly so that treatment may be commenced at an early stage. In 25 out of 179 trees disinfected by this method the fungus reappeared at the edge of the wound after periods ranging from one to eight months. A month after treatment the average breadth of the wounds is reduced from 5 to 3 cm. and within a year, in successful cases, complete healing takes place. For larger wounds at least two years are required for the overgrowth of the diseased area by healthy cortex. The frequency of infection shows a sharp periodicity, culminating in the spring or early summer; in general, the disease is little in evidence from July to December, so that in some cases treatment may profitably be restricted to the wet monsoon. Considerable benefit was derived from painting the stem base with tar from 5 cm. below to 50 cm. above soil level, one application being made at the beginning of the wet season and another in the middle of it. Trees that are almost ringed may be saved by inarching Japanese citron [*Citrus medica*] seedlings above the wound; this practice would probably also be generally beneficial to orange trees with a stem circumference of over 20 cm. by diminishing their liability to severe attacks of gummosis.

FAWCETT (H. S.). **Diaporthe citri (Faw.) Wolf, the perfect stage of Phomopsis citri and P. californica.**—*Phytopath.*, xxii, 11, p. 928, 1932.

The perfect stage of *Phomopsis californica* [*R.A.M.*, xii, p. 89] has been studied and found to be indistinguishable from *Diaporthe citri* described by Wolf as that of *P. citri* [ibid., vi, p. 159]. The writer has further examined numerous isolations made by R. G. Tomkins, of Cambridge, from fruits from Palestine, South Africa, Brazil, Spain, Florida, and elsewhere, and no characteristic differences warranting the separation of these isolations from the Californian could be detected. Certain isolations sent by K. Nakata from Japan also appear to be identical, so that the species would seem to be of world-wide distribution. The occurrence of melanose is believed to depend largely on climatic conditions, this manifestation of the fungus being much more prevalent in Florida than in California or Palestine.

PETRI (L.). **L'applicazione della terapia interna contro il 'mal secco' dei Limoni.** [The application of internal therapy against 'mal secco' of Lemons.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 2, pp. 236–237, 1932.

Since 0·5 per cent. uspulun-universal was applied in 1930 to the base of lemons grafted on bitter orange at Messina in an attempt to prevent infection by the organism causing 'mal secco' disease (*Deuterophoma tracheiphila*) [*R.A.M.*, xi, pp. 174, 175] through internal absorption of mercury, the trees have remained healthy.

Quantitative analysis showed only very minute traces of mercury in the leaves of the treated trees and very little more in the woody tissues of the twigs, in the expressed juice of which *D. tracheiphila* was able to live. No definite conclusions can safely be drawn from these experiments as yet.

RABINOVITZ-SERENI (D.). **Ricerche biologiche sulla Rhizoctonia dei semenzai di Citrus.** [Biological researches on the *Rhizoctonia* of Citrus seed-beds.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 2, pp. 187–209, 4 figs., 1 graph, 1932.

Investigations into the biology of *Rhizoctonia* [*Corticium*] *solani* isolated from bitter orange seedlings [*Citrus aurantium* var. *bigaradia*] grown from seed obtained from Eritrea and killed by the fungus just after germinating (stated to be the first record of *C. solani* on citrus seedlings in Italy) [cf. *R.A.M.*, viii, p. 235; x, p. 24], showed that the minimum growth temperature was 10° C., the maximum 40°, and the optimum between 20° and 25°. The growth rate was the same in light and darkness. Growth occurred on media of $P_H$ 2·8 to 9·8, the optimum being $P_H$ 7 [cf. ibid., i, p. 202]. A small quantity of acids was produced during growth. Commercial copper and sulphur fungicides did not inhibit growth, which was, however, completely arrested by uspulun (1 in 500), tillantina (1 in 500), and granosan [ibid., xii, p. 140] (1 in 25,000), and almost completely by mercuric chloride (1 in 25,000). Granosan is regarded as an excellent disinfectant for wheat, oats, barley, and cotton seed. Inoculations of two-year-old bitter orange seedlings gave negative results.

A bibliography of 32 titles is appended.

SAVASTANO (G.) **L' endoxerosi del Limone in Sicilia.** [Endoxerosis of the Lemon in Sicily.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 2, pp. 169–186, 2 pl., 1932.

Under Sicilian conditions, internal decline of lemons [*R.A.M.*, x, p. 376], known locally for fifty years but not hitherto mentioned in Italian phytopathological literature, occurs regularly between May and September with an intensity dependent on the prevailing weather. The characteristic symptom is a chestnut discoloration of the fibrovascular bundles, most conspicuous along the axis of the placenta near the stem end, where a reddish tinge is sometimes discernible. Green, mature, and senescent fruits are all susceptible, severe attacks causing premature dropping even of the first-named. The condition may be recognized by removing the stalk and noting the discoloured bundles. Mature affected fruits generally float stem end up in water. The condition is less serious

than in California, as it is less favoured by the climate of Sicily and occurs when much of the crop is unripe and therefore less susceptible.

Gum is present in the tissues of the placenta [cf. ibid., ii, p. 406], producing the chestnut discoloration, as well as along the whole length of the fibrovascular bundles, where it occurs in irregular, intermittent patches wholly or partly obstructing the lumen of the vessels. Zones of gummy occlusion are also found in the xylem of the stalk.

The attacks are limited almost exclusively to lemons grown for the early summer market, occasional attacks on later crops being associated with compact soil or injured roots. Trees badly attacked by gummosis are more susceptible than others. Very light soils deficient in organic material also conduce to the condition [cf. ibid., x, p. 377].

The physiological factors inducing an attack are (1) excessive transpiration during hot, dry periods, (2) the drawing away of water from the fruits towards the leaves, and (3) the inability of the roots to supply the leaves with sufficient water, either because of deficient soil humidity or because of too great a difference between air and soil temperature.

To control the disease it is recommended that the first spring irrigation should be delayed until really required. The annual forcing of early summer lemons should cease, the cultural practices involved enormously increasing the risk of an attack. Irrigation must be very carefully suited to the soil, and when the hot winds prevail the trees should be given more water. Organic manures should be applied to sandy soils. Susceptible orchards should be protected by windbreaks. If attacks are frequent in hot, dry weather a large proportion of the fruits should be picked irrespective of size, otherwise the whole crop may be lost.

In order not to reduce the value of the consignments, affected fruits should not be exported.

[Young (W. J.) & Read (F. M.).] **Citrus Preservation Committee —Progress Report (October, 1932.).**—*Journ. Australian Council Sci. & Indus. Res.*, v, 4, pp. 201–204, 1932.

In tests conducted over a period of four years in Australia, washing with 5 per cent. borax or 2·5 or 5 per cent. sodium bicarbonate did not prolong the life of navel oranges in cool storage [cf. *R.A.M.*, x, p. 728; xi, p. 105]. Washing Valencia oranges with borax reduced *Alternaria* stem-end rot [*A. citri*: ibid., ix, p. 775], but sodium bicarbonate did not consistently do so. Coating navel oranges with paraffin wax after washing was of no advantage except in improving their appearance, heavy applications actually shortening the life of the fruit. On Valencia oranges the paraffin did not cause premature collapse and usually reduced skin browning. Paraffin spraying was almost as effective as borax in reducing stem-end rot; the best treatment consisted in borax followed by a paraffin spray. The experimental Valencia oranges when carefully handled remained in good commercial condition without any treatment for three months, and it was only then that wastage due to *A. citri* set in. Navel oranges, on the other

hand, cannot be safely kept in cool storage beyond about five weeks. The treatment greatly improved the appearance of dirty navel and Valencia oranges.

NEAL (D. C.) & WESTER (R. E.). **Effects of anaerobic conditions on the growth of the Cotton-root-rot fungus, Phymatotrichum omnivorum.**—*Phytopath.*, xxii, 11, pp. 917–920, 1 fig., 1932.

The growth of *Phymatotrichum omnivorum*, the causal organism of cotton root rot in Texas, was found in laboratory experiments to be inhibited by anaerobic conditions and considerably restricted by concentrations of carbon dioxide exceeding 25 per cent. [*R.A.M.*, xi, p. 640]. It is, however, not killed in an atmosphere of 100 per cent. nitrogen or carbon dioxide and growth is soon resumed on its return to aerobic conditions. Possibly the aerobic requirements of the fungus may explain the differences in root rot infection observed in cotton fields following such treatments as subsoiling, fallowing, or fallow combined with deep tillage. Subsoiling infested areas in the late summer or early autumn may provide the necessary aeration for sclerotial germination, thereby reducing the chances of winter survival of the fungus. The recurrence of the disease in areas kept in clean fallow for three or four years may be due to the anaerobic conditions of the subsoil in the highly calcareous, black waxy lands of Texas, as well as to deep-seated infections in tree roots below the plough sole.

PETCH (T.). **A list of the entomogenous fungi of Great Britain.** —*Trans. Brit. Mycol. Soc.*, xvii, 3, pp. 170–178, 1932.

This is an annotated list of 54 species of entomogenous fungi occurring in Great Britain, some of which were recorded for the first time in 1930 and 1931 [cf. *R.A.M.*, xi, p. 640]. It includes a few species considered to be new to science, Latin diagnoses of which are appended, and terminates with brief notes on *Melanospora parasitica* and *Sporotrichum isariae* which were found parasitizing *Cordyceps militaris* and *Isaria farinosa*, and *I. farinosa*, respectively.

REYES (G. M.). **An unreported fungous disease of the Philippine migratory locust.**—*Philipp. Journ. of Sci.*, xlix, 3, pp. 407–418, 5 pl., 1932.

In September, 1929, migratory locusts (*Locusta migratoria* var. *migratorioides*) at the Alabang locust laboratory were heavily infested by *Beauveria globulifera* [*R.A.M.*, vi, p. 610], said to be reported for the first time from the Philippines. Diseased insects suffer from loss of appetite, weakness, and muscular paralysis ending in death. On dissection the affected insects were found to contain hyphae in the air cavities of the thorax, and in the thoracic and abdominal tissues, while mycelial tufts emerge from certain parts of the body and extend over the chitinous integument. The most conspicuous external feature of the disease, however, is the presence of a cottony-white, floccose growth, protruding from the junctures of the body segments and the joints of the legs. Later these white mycelial masses sporulate heavily and

assume an ivory or creamy tint. The diseased insects become mummified, the fungus covering practically the whole carcass.

The fungus was readily isolated on potato glucose agar and proved to be highly pathogenic to the locusts, especially to young and newly moulted individuals. *B. globulifera* was still viable after 295 days at room temperature (28° to 32° C.) and after 320 in the ice box (13° to 15°); steamed glutinous rice was found to constitute a particularly suitable medium for its growth.

Reyes (G. M.). **Artificial infection of the Coconut leaf miner with Beauveria globulifera (Spegazzini) Picard.**—*Philipp. Journ. of Sci.*, xlix, 3, pp. 419–441, 5 pl., 1932.

An investigation was made of the practicability of introducing the fungus *Beauveria globulifera,* isolated from migratory locusts (*Locusta migratoria* var. *migratorioides*) [see preceding abstract], into the regions of the Philippines infested by the coco-nut leaf miner (*Promecotheca cumingii*) [*R.A.M.*, xi, p. 780]. The best results in the artificial inoculation experiments (67·4 per cent. infection in the field and 73·2 per cent. in the greenhouse) were given by spraying the coco-nut leaf beetles with a spore suspension of the fungus during their feeding on the foliage. The fungus showed no tendency to infect the minute hymenopterous parasites of the leaf miner larvae.

Jacobson (H. P.). **Fungous diseases: a clinico-mycological text.**—ix + 314 pp., 153 figs., London, Baillière, Tindall & Cox 1932.

The author's aim in this monograph is to present to medical students and practitioners 'a comprehensive, concise, and readable discussion of the subject of clinical mycology', based on his experience as attending dermatologist to the Los Angeles County General Hospital. The work is divided into sections on the dermatomycoses (defined as primary cutaneous mycoses with usually no definite systemic involvement); and the following conditions frequently accompanied by systemic involvement: moniliasis, maduromycosis (mycetoma), sporotrichosis, blastomycosis, actinomycosis, coccidiosis (California disease, coccidioidal granuloma due to *Coccidioides immitis*) [*R.A.M.*, xii, p. 171], torulosis, and aspergillosis. Each section is followed by a bibliography of relevant literature.

Acton (H. W.), Pasricha (C. L.), Roy (A. C.), & Das Gupta (S. M.). **A new vegetable culture medium made from the papain digest of Mung Dâl (Phaseolus mungo), green variety.**—*Indian Med. Gaz.*, lxvii, 11, pp. 619–623, 1932.

A method is described for preparing a pure vegetable culture medium by digesting green mung dâl (*Phaseolus mungo*) with papain at a temperature of 60° to 65° C. for four hours. The broth has proved more satisfactory for the cultivation of the intestinal bacteria and bacteriophage than mutton broth or peptone water, while solid media prepared from the broth give a very good growth of various common fungi pathogenic to man.

Khouri (J.) **Sur une Monilia isolée des crachats d'un malade atteint de blastomycose pulmonaire : Monilia aegyptiaca.** [On a *Monilia* isolated from the sputum of a patient suffering from pulmonary blastomycosis: *Monilia aegyptiaca.*]—*Comptes rendus Soc. de Biol.*, cxi, 33, pp. 419–420, 1932.

From the sputa of a patient suffering from an acute attack of pulmonary blastomycosis which terminated fatally, at Alexandria, the writer isolated a fungus characterized by creamy-white colonies on Sabouraud's agar, on which spherical or ovoid elements (3 to 8, average 5 $\mu$) developed. The best growth occurred between 36° and 37° C. The organism, which was identified as a species of *Monilia* related to *M.* [*Candida*] *tropicalis* [*R.A.M.*, xi, p. 373] and *M. pulmonalis*, is named *M. aegyptiaca.* It is Gram-positive, fermenting the majority of sugars, sometimes with gas formation, but not liquefying gelatine or coagulated serum. Inoculation experiments on guinea-pigs and rabbits resulted in loss of weight and temporary debility.

Cerri (Laura). **L'Oospora D'Agatae Sacc. è sinonimo di Torula sacchari Corda.** [*Oospora d'agatae* Sacc. is a synonym of *Torula sacchari* Corda.]—*Atti Ist. Bot. R. Univ. di Pavia*, Ser. IV[a], iii, pp. 167–173, 1932.

From a comparative systematic study the author concludes that *Oospora d'agatae* isolated by D'Agata from a human dermatomycosis is identical with the earlier described *Torula sacchari* [*R.A.M.*, xi, p. 572]. The conidia of the genus *Oospora* are hyaline or bright and are never dark, whereas those of the genus *Torula*, and of *T. sacchari* Corda in particular, were, in all the cultures examined by the author, yellowish or dark. Notes are given on the morphology and cultural characters of the fungus.

Davidson (A. M.) & Gregory (P. H.). **Note on an investigation into the fluorescence of hairs infected by certain fungi.**—*Canadian Journ. of Res.*, vii, 4, pp. 378–385, 1 pl., 1 fig., 1932.

The conclusion reached by the writers as a result of further studies on the fluorescence of human hairs infected by *Achorion schoenleini*, *Microsporon audouini*, and *M. felineum* [*R.A.M.*, xii, p. 23] is that this phenomenon is due to some change in the hair substance following fungal invasion. Only that part of the hair actually penetrated by the hyphae is fluorescent. It appeared possible that the hyphae excrete an enzyme into the surrounding tissue, and some product of hydrolysis of the keratin or other body present in the hair may be the fluorescent substance.

Details are given of experiments in which a vivid green fluorescent substance was extracted with warm water from hairs infected by the above-mentioned organisms. Repeated attempts to extract a similar substance from hairs infected by species of *Trichophyton*, e.g., *T. gypseum*, *T. album*, and *T. violaceum*, or by normal hair, gave negative results. The bluish-white fluorescence of some *Trichophyton*-infected hairs, therefore, is not due to the same substance as in the hairs infected by *Achorion* or *Microsporon*.

DAVIDSON (A. M.) & GREGORY (P. H.). **A case of kerion celsi associated with ringworm of the eyelashes and accompanied by a trichophytid.**—*Canadian Med. Assoc. Journ.*, xxvii, 5, pp. 485–487, 3 figs., 1932.

Two cases of kerion celsi associated with *Trichophyton album* [*R.A.M.*, xi, p. 783 and preceding abstract] are reported, one being also accompanied by lesions of the eyelids. The source of infection is believed to have been cattle. The fungus, which is characterized by white colonies, concatenate spores 4 to 6 $\mu$ in diameter, and chlamydospores 15 to 20 $\mu$ in diameter, is stated to have been encountered on five patients at Winnipeg during the past two years. *T. album* is better adapted to parasitic life in the human body than are the more superficial species of dermatophytes, e.g., *T. violaceum*, as indicated by the comparatively violent physical reactions and also the more extensive growth of the organism in blood serum than on Sabouraud's medium.

FERRARI (ANGELA). **Ricerche sul Cryptococcus metaniger Cast.** [Researches on *Cryptococcus metaniger* Cast.]—*Atti Ist. Bot. R. Univ. di Pavia*, Ser. IV$^{a}$, iii, pp. 175–184, 3 figs., 1932.

From a study of morphological and physiological characters the author concludes that *Cryptococcus metaniger* Castellani [found in 1926 associated with a human mycosis] should be transferred to the genus *Cladosporium*; she renames the organism *C. metaniger* (Cast.) Ferrari. A Latin diagnosis is given.

NAKAMURA (T.) & TAKATSUKI (S.). **Über einen Fall von Acremoniose.** [On a case of acremoniosis.]—*Japanese Journ. of Dermatol.*, xxxii, 11, pp. 1100–1108, 13 figs., 1932. [Japanese, with German summary on p. 125.]

From a human tumour, the size of a sparrow's egg, the writers isolated a fungus characterized on Sabouraud's agar by greyish-white, later blackish-grey, radial colonies with brownish-white, setose outgrowths in the centre. The conidia are borne successively at the apex of conidiophores arising from the branched, septate mycelium, and thus resemble those of *Cephalosporium* except that the spores are not collected into a head. The fungus, which was pathogenic to laboratory animals, is classified as a new species of *Acremonium*, *A. keio*, allied to *A. potronii*.

MACY (H.), COULTER (S. T.), & COMBS (W. B.). **Observations on the quantitative changes in the microflora during the manufacture and storage of butter.**—*Minnesota Agric. Exper. Stat. Tech. Bull.* 82, 36 pp., 1932.

Data relating to the moulds (excluding yeasts and bacteria) in a typical Minnesota creamery showed that the cream on arrival contained usually between 10 and 1,000 moulds per c.c., but that pasteurization destroyed them all, as well as from 88·98 to 100 per cent. of the yeasts and from 94·20 to 99·99 per cent. of the bacteria. The number of micro-organisms in the raw cream was found to be highest in summer months, contamination by moulds being specially prevalent at harvest time when much dust is present in the atmosphere. In this connexion attention is drawn to the

necessity for proper ventilation and frequent painting to retard mould growth on walls and ceilings, as well as for the elimination of overhead piping or other obstructions liable to collect dust. The churn was shown to cause the greatest contamination of the butter by moulds [*R.A.M.*, xi, p. 181]. Moulds, yeasts, and bacteria in unsalted butters showed a marked tendency to increase during storage, whereas there was a decline in the numbers of micro-organisms in most of the stored salted samples. The higher the salt content of the butter, the greater was its effect on the yeast and bacterial counts, but this did not invariably hold good for the moulds.

DEMETER (K. J.) & MOSSEL (H.). **Zur Bekämpfung der Braunfleckigkeit von Camembert-Käse (Erreger: Penicillium bruno-violaceum Biourge).** [On the control of the brown spotting of Camembert cheese (causal organism: *Penicillium bruno-violaceum* Biourge).]—*Milchwirtschaftl. Forsch.*, xiii, 2–3, pp. 248–262, 1932.

Numerous complaints having been received from various parts of Germany regarding the prevalence of a brown spotting of Camembert cheese, investigations were conducted at the Munich Technical College on the control of the causal organism, *Penicillium bruno-violaceum*. The chief source of contamination appears to be the rennet extract used in the preparation of the cheese, so that the foremost preventive measure is the preservation of this extract from moulds and yeasts. Other precautions should include the weekly fumigation of the cheese-making rooms with sulphur for five to six hours; frequent disinfection of all vessels, &c., with 0·3 per cent. hot caporit [*R.A.M.*, ix, p. 803]; ventilation by means of a Delbag-Absolut-Filter installation; avoidance of over-salting; and heavy inoculation of the cauldron milk with the proper mould cultures obtained from a reliable source (200 to 300 c.c. per 1,000 l. milk).

BOLLEY (H. L.) & MANNS (T. F.). **Fungi of Flaxseed and Flax-sick soil.**—*North Dakota Agric. Exper. Stat. Bull.* 259 (Technical), 57 pp., 9 pl., 9 figs., 1932.

Several fungi have been found associated with flax wilt and soil 'sickness' in the authors' investigations at Fargo, North Dakota, of 70 American and European flax seed samples, the most important being *Fusarium lini* from the United States, Canada, Russia, Austria, and Holland [*R.A.M.*, xii, p. 95]; *F. russianum* Manns n. sp. from Russia, Austria, Canada, and the United States; *Colletotrichum lini* Manns and Bolley n. comb. (syn. *Gloeosporium lini* Westerdijk and *C. linicolum* Pethybridge and Lafferty) [ibid., x, p. 597 *et passim*] from Holland, Austria, Russia, Canada, and the United States; and *Alternaria* sp. from Austria, Russia, Holland, Canada, and the United States.

*F. russianum* is characterized by irregularly branched hyphae, averaging 2 $\mu$ in diameter; cream-coloured, erumpent sporodochia; short, branched conidiophores; and fusiform to crescent-shaped, 3- to 7- (usually 5-) septate conidia, 35 to 50 by 4 to 5 $\mu$; the colonies produced on 2 per cent. glucose agar and potato plug are

port-wine coloured. The fungus is parasitic on flax, causing seedling wilt and shrivelling of the seed in maturing plants. It is seed-borne and a common agent of 'sickness' in flax soils, often in conjunction with *F. lini.*

*F. terrestris* Manns n. sp. was isolated in profusion from flax-sick soil but has so far given no evidence of pathogenicity in inoculation tests. It has irregularly branching hyphae, averaging 2·5 $\mu$ in diameter; slender conidiophores 5 to 10 $\mu$ long; hyaline, fusiform to crescent-shaped, 3- to 7- (usually 5-) septate conidia, 30 to 48 by 3·5 to 5 $\mu$ (average 40 by 4 $\mu$); spherical chlamydospores 10 to 15 $\mu$ in diameter: and a sterile body, 25 to 30 $\mu$ in diameter, formed at the tips of the hyphae.

*C. lini* is stated to have been originally described by T. F. Manns in an unpublished thesis in 1903. Bolley's *C. lini* of 1910 is a *nomen nudum* and Miss Westerdijk's transference of the fungus to *Gloeosporium lini* (1916) is not accepted by the writers. *C. linicolum* Pethybridge and Lafferty being identical with *C. lini*, it is claimed that the name conferred on the organism by Manns in 1903 should take priority [cf. ibid., iv, p. 219]. *C. lini* is characterized by subhyaline to dark or fuliginous, abundantly septate hyphae, averaging 3·5 $\mu$ in diameter; bi- to triseptate, dark brown setae, 70 to 130 $\mu$ in length; biguttulate, hyaline, allantoid conidia, 15 to 20 by 2 to 4·5 $\mu$; and olive to brown, spherical or oval chlamydospores, 10 to 12 by 10 to 15 $\mu$.

All types of seed-borne spores on flax may be readily obtained by centrifuging at about 2,000 revolutions per minute. The pathogenicity of the organisms (which are carried on some 80 per cent. of north-western seed samples) was tested by inoculating graded and treated flax seed, planted and grown in sterile soil. Several of the fungi under discussion cause shrunken spots or streaks on the seed coats and injury to the seed leaves on which they are apparent when the cotyledons emerge from the testa.

*F. lini* (the most destructive and widespread flax parasite) penetrates the soil to a depth of at least 12 inches, but occurs most abundantly at depths not exceeding 5 inches. Under continuous cropping of flax in 'sick' soil, up to 45,000 colonies of this organism may be obtained per gm. of soil. No evidence was available in the authors' investigations that *Asterocystis radicis* [ibid., xi, p. 182] is responsible for any type of flax 'sickness'. The sandy loam soils so well adapted to flax raising appear to be very favourable to the fungi causing 'sickness', the control of which can only be effected by lengthy rotations, careful seed cleaning, grading, and disinfection with formaldehyde (2 in 1,000), and the development of immune or resistant varieties. The incidence of soil infection may also be reduced by the application of well-composted farmyard manure containing flax straw.

Peltier (G. L.) & Schroeder (F. R.). **The nature of resistance in Alfalfa to wilt (Aplanobacter insidiosum L. Mc.)**—*Nebraska Agric. Exper. Stat. Res. Bull.* 63, 28 pp., 12 pl., 1932.

Numerous sections of lucerne plants of various ages in different stages of wilt disease (*Aplanobacter insidiosum*) [*R.A.M.*, xi, p. 787] have been examined and interpreted in the light of

evidence obtained in five years' intensive field and greenhouse studies in Nebraska, both naturally and artificially infected material being used.

One of the most striking differences between susceptible and resistant varieties was found to be the relative diameter and construction of the xylem elements in the roots. Thus, in the resistant Turkestan the vessels are not only much smaller than in the susceptible varieties, e.g., Grimm and Arizona, but they appear angular with heavy wall thickenings, which are absent from the secondary and tertiary walls of the susceptible sorts. The vessels of resistant varieties reach maturity more rapidly than those of susceptible ones. In the susceptible Grimm the vessels consist of fairly long cells from which the cross septations have disappeared, so that no obstruction is offered to the passage of the bacteria. In Turkestan, on the other hand, the vascular cells are shorter and larger vestiges of the cross walls remain to constitute a barrier to bacterial penetration. The radial spread of the bacteria is also much more rapid in roots with the bundles loosely arranged in single rows (Arizona) than in those where the vessels occur in groups more or less surrounded by wood fibres, the latter being composed of insoluble lignin and therefore impenetrable by the organisms. In the susceptible Arizona variety the parenchymatous tissue (wood rays) is often in direct contact with the vessels, a phenomenon seldom observed in the resistant sorts owing to the presence of the surrounding wood fibres. Moreover, the walls of the medullary ray cells of the resistant varieties seem to be relatively heavier and with smaller intercellular spaces than those of the susceptible ones.

Rapidly growing lucerne varieties have generally been found susceptible to wilt, while those developing more slowly are resistant. The rate of growth seems to be associated with certain of the structural peculiarities favouring either resistance or susceptibility to the parasite indicated above. The moisture content of the soil, however, may be so adjusted as to modify the natural root structure and growth rate very considerably and thereby to induce comparative resistance in susceptible varieties and relative susceptibility in resistant ones.

The curtailment of organic food reserves in the roots of diseased plants bears an important relation to wilt development, and may be due to the disturbance of the photosynthetic and food storage activities. Starch was observed to be practically absent from the medullary ray and wood parenchyma cells of diseased Grimm and Turkestan plants, whereas it filled the corresponding cells of healthy plants.

SAMPSON (KATHLEEN). **Observations on a new species of Olpidium occurring in the root hairs of Agrostis.**—*Trans. Brit. Mycol. Soc.*, xvii, 3, pp. 182–194, 3 pl., 5 figs., 1932.

This is a detailed account of the morphology and cytology of a species of *Olpidium* which was found causing apical swellings of the root hairs of *Agrostis stolonifera* in Yorkshire, and more rarely occurring in the base of the hairs or in other epidermal cells. The organism is described as a species new to science under

the name *O. agrostidis*, and English and Latin diagnoses are appended. It is characterized by oval to elongated zoosporangia, 30 to 68 by 10 to 23 $\mu$, with 1 to 4, usually short, tubes of discharge; colourless, subglobose, 1-ciliate zoospores, about 2·2 $\mu$ in diameter; and solitary or aggregated, elliptical or ovoid, smooth, hyaline, thick-walled resting spores, 20 to 30 by 9 to 17 $\mu$ in diameter. The latter are invariably binucleate to a mature age, suggesting that they arise from the copulation of zoospores.

DOWNES (A. C.). **Black spot of Roses.**—*Gard. Chron.*, xcii, 2394, pp. 358–359, 1932.

An account is given of the writer's attempts to control black spot of roses [*Diplocarpon rosae*: *R.A.M.*, xii, p. 25] in his Surrey garden, where the disease occurs in a severe form on the sweet-briars Lady Penzance and Rose Bradwardine, the pillar varieties Allen Chandler, Paul's Scarlet Climber, Pax, Vanity, and Phyllis Bide, and the garden roses Mrs. Oakley Fisher, Mabel Morse, Mrs. Campbell Hall, Ophelia, Madame Butterfly, Mrs. Henry Morse, Lady Pirrie, Los Angeles, Mrs. Henry Bowles, Madame Abel Chatenay, Mrs. C. V. Haworth, Lady Roundway, Golden Emblem, and the ordinarily resistant Shot Silk. All these varieties are of the paler type of colouring. *Rosa nitida, R. moyesii, R. hugonis, R. lucida, R. giraldii, R. sericea, R. omeiensis, R. complicata, R. macrophylla, R. nuttalliana, R. pisocarpa, R. rubrifolia*, and Pink China appear to be immune, while Mermaid, George Dickson, Wilhelm Kordes, and (in the current year) Hoosier Beauty and G. J. Glassford are resistant. The disease has been held in check by the systematic application of ammonium polysulphide and nicotine soap at about twice the strength recommended [usually ½ gall. A.P.S. to 100 galls.] against mildew [*Sphaerotheca pannosa*: ibid., iv, p. 299].

PETHYBRIDGE (G. H.) & SMITH (K. M.). **A suspected virus disease of zonal Pelargoniums.**—*Gard. Chron.*, xcii, 2395, pp. 378–379, 2 figs., 1932.

From several parts of England zonal pelargoniums [*Pelargonium zonatum*] of the King of Denmark and Paul Crampel varieties have been submitted for examination to the Plant Pathological Laboratory of the Ministry of Agriculture on account of leaf curl and chlorosis [*R.A.M.*, xi, p. 649]. Round Cambridge the disease is so common that it was impossible to procure absolutely healthy plants for experimental purposes except by raising them from seed.

The young leaves first develop pale spots that gradually expand into rounded, stellate, or dendritic blotches of a bright yellow colour, often surrounded by one or more concentric rings of a lighter shade. Later the lesions become necrotic, the tissues shrivelling and turning brown, but growth in the neighbouring parts of the lamina continues, giving the leaf a crinkled and puckered aspect, sometimes accompanied by splitting. In severe cases the whole plant becomes malformed and degenerate. Temporary recovery is a striking feature of the disease.

The symptoms and course of this disturbance being strongly

suggestive of a virus, investigations were begun and are still in progress at the Virus Research Station of the School of Agriculture, Cambridge. Scions from diseased plants were grafted on to healthy stocks raised from seed, the young leaves of which developed the above-mentioned symptoms in thirty to forty days. Transmission by artificial inoculation has hitherto been unsuccessful except in one or two doubtful cases, and so far no evidence is forthcoming that insects may be involved.

BROWN (NELLIE A.). **Another gall-forming bacterium.**—*Phytopath.*, xxii, 11, pp. 924–925, 1 fig., 1932.

Grafted plants of *Gypsophila paniculata* in a New Jersey nursery were destroyed in 1932 by a soft, nodular gall of the type associated with the pocket disease of sugar beets (*Bacterium beticola*) [*R.A.M.*, x, p. 424]. The tumours ranged from ½ to 3 cm. in diameter and were sound and creamy-white, with water soaked areas, when cut across. The causal organism is a motile rod with bipolar flagella, capable of growth at very high and very low temperatures. Inoculation experiments gave positive results on *G. paniculata* but failed to produce infection on sugar beets, *Ricinus* [*communis*], *Bryophyllum*, tomato, and garden balsam [*Impatiens balsamina*]. The bacterium under observation appears to be distinct from any of the known gall-forming organisms, but further morphological studies are required to ascertain definitely that it is not related to *Bact. beticola*.

GREGORY (P. H.). **The Fusarium bulb rot of Narcissus.**—*Ann. of Appl. Biol.*, xix, 4, pp. 475–514, 1 pl., 2 graphs, 1932.

This is a detailed account of the author's investigation of the rot of narcissus bulbs associated with *Fusarium bulbigenum* [*R.A.M.*, ix, p. 623; x, p. 795], the symptoms of which in stored bulbs and in the field are briefly described. Isolations from diseased stored bulbs yielded two strains of this species [the cultural characters of which are described] in the majority of cases, among many other organisms, including two strains of *F. moniliforme* [*Gibberella moniliformis*] and one of *Cylindrocarpon radicicola* [loc. cit.] which came next in order of frequency and a description of which in culture is also included.

Typical symptoms of the storage rot were reproduced by inoculating healthy narcissus bulbs through wounds with both strains of *F. bulbigenum*, which was readily recovered. The fungus was apparently unable to penetrate the tissues in the absence of wounding, and inoculation of the roots failed to produce infection. On the other hand, inoculations with *G. moniliformis* and *C. radicicola* consistently gave negative results, and the author concludes that *F. bulbigenum* is the causal agent of the rot. There was evidence of considerable variations of the relative resistance of different varieties of narcissus to the fungus.

In nature *F. bulbigenum* was found usually attacking the bulbs from the base upwards, but occasionally it was observed entering through the apex, especially in bulbs with two apices, in which case a very frequent point of attack was at the junction of the two components. So far no proof has been obtained that the

fungus enters the base of the bulb from infected soil through the dying roots, as Weiss stated to be the case in America [ibid., viii, p. 383].

In infected stored bulbs high temperature and high humidity were found to aggravate the disease, but neither appeared to affect adversely the condition of healthy bulbs in storage. No support was found for the claim that early planting of the bulbs has a controlling effect on the development of the rot in the field. Experiments with formalin, mercuric chloride, uspulun, and ceresan indicated that surface sterilization of the bulbs may be effective in reducing the amount of rotting during storage. Hot water treatment of the bulbs against eelworms appeared to favour the spread of the disease, this agreeing with Weiss's experience.

**Twenty-fourth Report of the Vermont State Horticultural Society.**—*Sixteenth Bienn. Rept. Vermont Commissioner of Agric. 1930–1932*, 116 pp., 6 pl., 1932.

The following items of phytopathological interest occur in this report. B. F. Lutman states that the apple varieties most susceptible to scab [*Venturia inaequalis*] in Vermont are McIntosh, Delicious, Fall Pippin, and Stayman; Grimes Golden is very resistant and a number of others are intermediate in their reaction to the fungus. Infection will occur in 13 to 18 hours at 43° F., in 9 to 11 at 48°, in 8½ at 59°, and in 4 to 6 at 68° to 75°. Commercial control in Vermont may usually be obtained by two applications of a fungicide between the delayed dormant and the calyx sprays. Recent experiments have shown that fair control results from dusting within 12 hours after an infection period and spraying within 40 to 48 hours.

M. B. Cummings explains the procedure of trapping the ascospores of *V. inaequalis* on glycerined slides. Under Vermont conditions discharge usually takes place in the early part of May, the critical period extending roughly from 20th April to 15th May. Spraying should be started as soon as the discharge begins in order to prevent infection.

Notes are given by R. E. Vaughan and M. B. Cummings on the occurrence and control of fireblight [*Bacillus amylovorus*] on apples in Vermont.

Rosen (H. R.). **Control of the blossom blight stage of fire blight.**—*Science*, N.S., lxxvi, 1976, pp. 447–448, 1932.

Further observations and experiments have been conducted in Arkansas with a view to the control of the blossom blight stage of fireblight [*Bacillus amylovorus*] in Jonathan apples [*R.A.M.*, xi, p. 160].

Four rows of heavily blighted trees (64) received the regular early season spray treatments, while seven rows (103 trees) were specially treated against blossom blight with five applications of a weak Bordeaux mixture (1–3–50), plus lead arsenate in the calyx and cover sprays, on four dates in April and one in May.

On the control trees receiving the ordinary treatment blight was observed on 25th April in 22 clusters, whereas none was detected in the Bordeaux-treated rows. Almost every control tree

showed a certain amount of blight by 5th May, though less than in the past few years, while those treated with Bordeaux were still quite healthy. On 9th May three out of the 103 Bordeaux-sprayed trees showed a total of five blighted blossom clusters. Secondary blight appeared to a limited extent on 18th May on about one-third of the controls and two of the Bordeaux-treated trees, the latter showing only four blighted leaf shoots in all.

Under experimental conditions, at any rate, blossom blight is evidently controllable by the treatment outlined above, but further observations are necessary to determine the general applicability of the schedule.

DUNEGAN (J. C.). **The occurrence of the perfect stage of Phomopsis mali in the United States.**—*Phytopath.*, xxii, 11, pp. 922–924, 1932.

A species of *Phomopsis* was repeatedly obtained from apple leaf spots near Fayetteville, Arkansas in 1931, and a comparison of the cultures with type material revealed their identity with *P. mali* [*R.A.M.*, ix, p. 658]. Perithecia, asci, and ascospores of a species of *Diaporthe* developed in 10 out of 34 isolations, and from these the pycnidial stage again arose and subsequently produced fresh perithecia. The globose perithecia are black externally, with an inner layer of brown tissue, and are furnished with curved, hairy, black beaks, 1 to 4 mm. long. The asci measure 40 to 60 by 5 to 7 $\mu$ and contain eight bicellular, hyaline, biguttulate spores, 9·5 to 13·5 by 2·7 to 3·8 $\mu$, obtuse at both ends, slightly constricted at the septum. The species is provisionally referred to *D. perniciosa* [cf. ibid., iv, p. 174; xi, p. 767] pending a critical study of European cultures and exsiccata.

BAKER (K. F.) & HEALD (F. D.). **Some problems concerning blue mold in relation to cleaning and packing of Apples.**—*Phytopath.*, xxii, 11, pp. 879–898, 1 fig., 1932.

The washing tank is one of the chief sources of contamination of apples by blue mould (*Penicillium expansum*) in Washington [*R.A.M.*, xi, p. 658]. An investigation was carried out to determine the degree of toxicity of three of the most commonly used washing solutions to the spores of the fungus. The preparations tested were 3 per cent. hydrochloric acid, sodium carbonate-borax (brogdite) [ibid., xi, pp. 54, 570], ½ to 1½ lb. per gall. water, and sodium carbonate-trisodium phosphate (laux, supplied by the Laux Laboratories, Seattle), at the rate of 60 lb. per 100 galls.

Old spores were found to be consistently more resistant to toxic agents than young ones. The temperature as well as the toxicity of the solutions was shown to be an important factor in the control of the mould. Hydrochloric acid killed all the spores in 72 hours at 90°, in 12 at 100°, and in 4 to 5 at 110° F. Brogdite destroyed all the spores in 24 hours at 90°, in 12 at 100°, and in 6 to 7 at 110°, while laux was completely toxic in 72 to 84 hours at 90°, in 48 to 60 at 100°, and killed 86 per cent. in 11 hours at 110°. The toxicity of brogdite was found to be due to the sodium carbonate constituent. The spores of the mould failed to germinate at room temperature or 90° in sterile distilled or tap water. Germination

occurred in sterile apple juice and Brown's synthetic medium at 32° in 7 days and in 12 hours in 2 per cent. apple juice at room temperature but not in 14 at 90°, while spores held at 21° to 25° in 10 per cent. apple juice for 101 hours germinated readily on being returned to room temperature. A sodium hypochlorite solution containing 3·4 per cent. available chlorine was found to be completely toxic in 15 minutes at a strength of 3 oz. per gall. and in 3 hours at 0·1 oz. per gall. This high toxicity renders sodium hypochlorite very suitable for use in the packing-house as a disinfectant of the walls, packing boxes, and the like.

WORMALD (H.). **Bacterial diseases of stone-fruit trees in Britain. IV. The organism causing bacterial canker of Plum trees.**—*Trans. Brit. Mycol. Soc.*, xvii, 3, pp. 157–169, 2 pl., 1932.

In this paper the author gives details of the experiments in which he established the pathogenicity to stone fruit trees of *Pseudomonas mors-prunorum* [*R.A.M.*, xi, p. 726], the cause of bacterial canker of plum trees in England, as well as a detailed description of the morphology and cultural characters of the organism [cf. ibid., xi, p. 379]. It differs from *P. prunicola* in its white cloudy growth in nutrient broth with 5 per cent. saccharose; rapid production of acid on nutrient agar with 5 per cent. saccharose, in which it usually dies in four to six days; reaction at first alkaline and then acid on agar with 2 per cent. lactose; and very faint or no yellow colour in Uschinsky's solution. Its index number in the Descriptive Chart of the Society of American Bacteriologists is 5021 – 31100 – 0222.

SCHILBERSZKY (K.). **Über die Ursachen der Apoplexie bei den Steinobstbäumen.** [On the causes of apoplexy in stone fruit trees.]—*Angew. Bot.*, xiv, 6, pp. 536–551, 1932.

The writer discusses, on the basis of protracted observations in Hungary, the factors contributing to the condition known as 'apoplexy' or gummosis of apricot, cherry, and other stone fruit trees [*R.A.M.*, xi, p. 791]. Among such factors are the obstruction of the water-conducting elements by tyloses and the gummification of the tracheae associated with abnormal enzymatic activity; the physiological effects of severe frosts, especially those occurring in the late winter and spring, when the flow of sap is resumed; and unfavourable soil constitution (excessive moisture or drought) [ibid., xii, p. 181] and unduly deep planting, which adversely influence the vital processes of the trees.

POOLE (R. F.). **Late infection of Peach leaf curl in the Carolinas.**—*Plant Disease Reporter*, xvi, 16, pp. 171–172, 1932. [Mimeographed.]

Peach leaf curl (*Exoascus* [*Taphrina*] *deformans*) has hitherto caused no damage of economic importance in the sandhill regions of North Carolina, but in 1932, when the largest fruits were half to three-quarters of an inch in diameter, small hypertrophied areas of infection by this fungus were observed, confined to the fruit, usually on one side and near the calyx end. The diseased

tissues enlarged throughout the summer, reaching half an inch in diameter. No infection was observed on the early varieties, Belle (Georgia), Hiley (Early Belle), Red Bird, and Carman, even when growing in proximity to infected Elberta and Hale [*R.A.M.*, ix, p. 535]. The highest incidence of infection on individual trees was 15 per cent. It is not clear where the inoculum originated nor why the foliage escaped infection. In 1930 several abandoned orchards in both North and South Carolina were almost completely defoliated by *T. deformans*, while the fruit showed less than 10 per cent. infection. The diseased peaches were reddish to purplish and made no further growth on the diseased side, resulting in a decided malformation. Similar symptoms were reported from Georgia in 1928.

Roberts (J. W.) & Dunegan (J. C.). **Peach brown rot.**—*U.S. Dept. of Agric. Tech. Bull.* 328, 59 pp., 10 pl., 1932.

The history of brown rot of peaches in the United States shows that the disease was reported at least a century ago, and its fungous origin was clearly understood by a number of early investigators. The taxonomic position of the causal organism is discussed at length, the writers reaffirming their previous contention that the name *Sclerotinia fructicola* should be used to describe it in preference to *S. americana* [*R.A.M.*, vi, p. 625].

*S. fructicola* occurs in the United States, Canada, Australia, and New Zealand. In the United States the disease is responsible for heavy losses, especially in the more humid districts, amounting to as much as $5,000,000 in seasons favourable to the development of the fungus. Generally speaking, the present-day peach varieties show a certain amount of resistance to brown rot, a quality that has been gained, however, at the expense of flavour.

The morphology and physiology of the fungus are described in detail in the light of the writers' own investigations and those of other workers. The optimum temperature for the growth of *S. fructicola* was found to lie between 75° and 80° F., temperatures above 90° considerably retarding growth. Conidial germination takes place at 32°, but little development is made at low temperatures. Conidia produced naturally in the orchard are capable of withstanding winter temperatures, and a few ascospores were found to be viable five weeks after their discharge. The fungus is disseminated by wind, rain, birds, insects, and man, wind being the most important.

The period of apothecial production from mummied fruits and the blossoming of peach trees have been found to coincide very closely for a number of years. Invasion of the fruit may occur through the uninjured epidermis, but as a rule the fungus enters through the punctures made by the plum curculio (*Conotrachelus nenuphar*) or the oriental fruit moth (*Grapholitha molesta*). Twig canker formation may result from the infection of either blossoms or fruits.

The fungus is intercellular in the tissues of the flowers and fruits. In the petals and sepals the mycelium spreads rapidly through the cells. The conidia germinate on the surface of the stigma and the germ-tubes grow down intercellularly among

the cells of the style. All the parenchymatous tissues of the ovary may be invaded; the mycelium was also observed in the spaces between the pollen grains in mature anthers. The middle lamella of the fruit cells is dissolved by the fungus. The first symptom of canker formation in the twig tissues is the presence of a discontinuous, narrow, brown zone in the cambial region, where the cell walls have collapsed; later a circle of gum pockets supersedes the brown zone, and the cortical parenchyma is destroyed.

The control of brown rot depends largely on the timely and thorough application of fungicides, combined with measures for the extermination of the plum curculio and proper orchard sanitation. *S. fructicola* being particularly susceptible to the vapours given off by ethyl alcohol, a number of substances were tested in the hope of finding one the fumes of which would kill the fungus on peaches either in closed compartments at packing houses or in refrigerator cars during transit. Growth was entirely prevented by glacial acetic acid, 95 per cent. alcohol, aniline, benzaldehyde, carbon tetrachloride, cassia oil, chloral hydrate, *Eucalyptus globulus* oil, eugenol, horsemint (*Monarda punctata*) oil, lemon oil, peppermint (*Mentha piperita*) oil, safrol, sassafras oil, thyme oil (light), toluene, tricresol, and wormseed oil. The odour and flavour of the fruit were, however, adversely affected by these substances.

CURZI (M.). **I tripidi come causa della 'malattia del pennacchio' del Pesco.** [Thrips as the cause of 'plume disease' of the Peach.]—*Bull. R. Staz. Pat. Veg.*, N.S., xii, 2, pp. 238–243, 2 figs., 1932.

The author has obtained evidence that the so-called 'plume' disease of Early Elberta peach trees in Italy [*R.A.M.*, xi, p. 462] is caused by a *Thrips*. The symptoms result from the traumatic and toxic effect of the punctures, and not from any infective principle conveyed by the insect. When the thrips disappear, the affected branches recover.

ATANASOFF (D.). Шарка по Сливитѣ. Една нова вирусна болесть. [Plum pox. A new virus disease.]—*Yearbook Univ. of Sofia, Fac. of Agric.*, Sofia, xi, pp. 49–70, 6 figs., 1932. [English summary.]

This is a detailed account of the preliminary investigation of a serious disease of the plum tree, which was first noticed about 1918 in a restricted area of south-west Bulgaria, whence it has gradually spread in all directions, until now it is very common in southern Bulgaria from the Jugo-Slavian frontier in the west to Philippopolis in the east; it is not known to occur, however, in the northern part of the kingdom. Economically it is important in that affected trees never yield fruit fit for table or preservation.

The disease, which presents some features in common with American 'buckskin' of cherries [*R.A.M.*, x, p. 528] (some cases of which were seen by the author near Sofia), is chiefly prevalent on the Kustendil local variety of *Prunus domestica*, the chief early symptom on which is the development on the leaves of very characteristic light or yellowish-green spots, blotches, streaks, or more or less completely closed rings, the last-named forms somewhat

resembling ring spots of tobacco. The diseased trees blossom and set fruit normally; no symptoms appear on the latter until it reaches normal size, when it begins to ripen from 10 to 15 or more days earlier than that of healthy trees, in which respect the disease resembles peach yellows. At this time, occasionally even earlier, the fruit develops one or more blue spots, frequently more or less ring-shaped with centres of normal colour. Gradually the spots become sunken, the surface of the plum taking on a pock-marked appearance. The tissues underlying the spots are usually necrotic, rust-coloured, dry, and shrunken, the lesion often extending down to the stone; sometimes, however, they may be quite normal, except for a red to purple colour. The necrotic tissues often contain pockets filled with gum. The diseased fruit usually drops off before maturity; it is very poor in sugar, and has an unpleasant taste. Except for the above-mentioned symptoms, affected trees are entirely normal in the initial stages of the disease; they degenerate very slowly, but gradually the smaller branches and annual shoots begin to die and the trees assume a sickly appearance.

Besides the Kustendil variety, the disease has also been recorded, with somewhat different symptoms (some of which are described), on the Dollan, Afeska, Bardaklia, and white greengage varieties, and also on the Brnyanka variety near Brno in Czecho-Slovakia. A careful review of the relevant literature leads the author to believe that the same disease has also been seen, but not investigated, in Kentucky [*R.A.M.*, viii, p. 111 and above, p. 205], Minnesota, Illinois, and Holland [ibid., x, p. 252] and that it may be identical with a disease described by Carne in Australia [ibid., v, p. 676] and by Dippenaar in South Africa [ibid., xi, p. 521].

The disease, which the author terms plum pox, was proved to be readily transmissible to healthy trees by grafting. The fact that outbreaks in new localities were almost invariably preceded by heavy infestation of the trees by the scale insect *Lecanium corni* may indicate that this insect is involved in the spread of the infection, and experiments are in hand to test this possibility. Cherry plum [*P. divaricata*], which is commonly used in Bulgaria as grafting stock, has so far proved to be entirely immune from the trouble.

The threatening nature of the disease calls for drastic control measures, such as the complete eradication and destruction by fire of all affected trees, which is the more to be recommended because such trees never recover and their economic value is practically nil.

Cooley (L. M.). **Mild streak of black Raspberries.**—*Phytopath.*, xxii, 11, pp. 905–910, 1932.

Mild streak is a disease of the black raspberry (*Rubus occidentalis*) believed to be caused by a virus [*R.A.M.*, x, p. 530] and apparently restricted to this host. The symptoms of the disturbance in Ohio include hooking, twisting, and recurving of the midribs of the leaflets at the tips of the new canes, accompanied by a slight downward curling of the other leaves, giving a slightly 'rosetted' appearance. The foliage is somewhat darker than the normal and the apical leaflets may show narrow steel-blue to grey streaks, which sometimes appear also on the stems of fruiting

laterals, on the petioles, and on flower or fruit pedicels. The fruit develops unevenly and is of a disagreeable flavour. Under local conditions these symptoms are most pronounced in July and August. The Cumberland variety is the most susceptible. Field evidence suggests that the streak principle is conveyed from plant to plant by an insect, but no definite results have yet been given by transmission tests. The disease recurs each season on plants once affected but does not develop into the severe type (eastern blue stem) [ibid., ii, p. 128 *et passim*].

STEVENS (N. E.). **Notable outbreaks of Cranberry fruit rots in Massachusetts.**—*Phytopath.*, xxii, 11, pp. 911–916, 2 graphs, 1932.

The results of a nine-year study of the relation between weather conditions and the keeping quality of cranberries in Massachusetts indicate that abnormally high temperatures during May and June, coupled with a heavy rainfall in July and August, favour the development of fruit rots [*R.A.M.*, xi, pp. 188, 662]. Such conditions prevailed at the time of the severe outbreaks of disease in 1914, 1922, and 1931, while an examination of the weather records shows that one or both of the adverse meteorological factors operated also in 1887, 1888, 1889, 1912, and 1915, in all of which years the keeping quality of the fruit was inferior. In 1901 and 1906 the fruit also kept badly, but no exact statistics regarding the weather of those seasons are available.

BIRMINGHAM (W. A.). **Two fungous diseases of the Loquat.**—*Agric. Gaz. New South Wales*, xliii, 11, pp. 863–867, 7 figs., 1932.

The author states that loquat material sent in for examination in 1931 by two nurserymen in New South Wales showed that in one case the leaves were attacked by a species of *Entomosporium* which caused numerous purplish-brown, more or less circular (generally localized) spots with light centres bearing acervuli of the fungus; in some cases the spots ran together, forming large necrotic areas, and resulting in malformation of the leaf. The stems were also badly cankered by the organism, but so far it has not been seen on the fruits. Reference is made to Putterill's record of a species of *Entomosporium* on this host in South Africa [*R.A.M.*, ii, p. 70], and also to the occurrence on the Northern Tablelands of New South Wales of *E. maculatum* [*Fabraea maculata*: ibid., x, p. 39] which, in some seasons, does considerable damage to pears, causing the disease commonly known as fleck, leaf blight, or scald. Although experiments on the control of the fungus on loquat were not made, it is believed from experience with the similar pear disease that it may be amenable to spraying with lime-sulphur just before blossoming, just after the fruit has set, and from time to time as the tree makes new leaf growth. All diseased material should be removed and burnt.

In the other case, the stems and leaves of young loquat trees were badly attacked by *Fusicladium* [*dendriticum* var.] *eriobotryae* [ibid., viii, p. 268]. On the leaves the fungus forms more or less circular to irregular, dark green, velvety, amphigenous spots,

occasionally spreading until most of the leaf is involved. The affected tissues become brittle and break away. On the shoots, small, greenish-black, velvety spots are formed, which ultimately spread and fuse, forming large elongated blotches. The disease on loquats was recorded in New South Wales in 1902 by Cobb. For its control the following spray programme is suggested: 6–4–40 Bordeaux mixture just prior to blossoming, 1 in 35 lime-sulphur immediately after petal drop, and periodically as required until the fruit is half grown, and 6–4–50 Bordeaux mixture after this, if weather conditions require. In the nursery, the disease might be controlled by periodical applications of 6–4–50 Bordeaux mixture, and by the removal and destruction of all infected material.

SOKOLOVSKAYA (Mme R. E.). Методы определения физических свойств инсектисидов и фунгисидов. [Methods of testing the physical properties of insecticides and fungicides.]—*Bull. Leningrad Inst. for Controlling Farm and Forest Pests*, 3, pp. 283–293, 6 figs., 1932.

In this paper the author briefly describes various methods and apparatus [almost exclusively German] for testing the physical properties of liquid and dust fungicides and insecticides, all of which appear to be well known.

HORSFALL (J. G.). **Red oxide of copper as a dust fungicide for combating damping-off by seed treatment.**—*New York (Geneva) Agric. Exper. Stat. Bull.* 615, 26 pp., 2 figs., 2 diags., 1932.

Details are given of a series of experiments on the control of damping-off (*Pythium ultimum*) in tomatoes [*R.A.M.*, xii, p. 122], eggplants, peppers (*Capsicum annuum*), and cabbage by means of seed treatment with red (or cuprous) oxide of copper (cuprite) dust [ibid., x, p. 371]; copper carbonate dust and copper sulphate solution and dust were used for comparison.

The tomato seed (John Baer) was shaken in an Erlenmeyer flask with an excess of dust (afterwards removed with a 20-mesh screen) and sown in greenhouse trays naturally contaminated by the fungus. Red oxide was found to be more effective than copper carbonate dust both against the pre- and post-emergence phases of damping-off. It was slightly superior to the copper sulphate soak (one hour) but less satisfactory than the copper sulphate dust for the pre-emergence phase, while it was definitely inferior to the copper sulphate soak for the post-emergence phase.

In the relatively few tests on Black Beauty eggplants, Harris's Early Giant pepper, and Enkhuizen Glory cabbage, red oxide increased the stand and reduced the incidence of damping-off. It is, in fact, particularly well adapted for use on the smooth seeds of these plants owing to its marked adhesive properties, considerably exceeding those of copper sulphate dust. Tests on tomato seeds showed that the amount of copper adhering after treatment with red oxide is nearly seven times as great as that remaining from copper sulphate applications (0·27 as against 0·04 mgm. per seed).

It was found that red oxide may safely be diluted to the extent of 25 per cent. with talc without impairing its fungicidal efficacy. Black (or cupric) oxide of copper failed to control damping-off in tomato and eggplant. Preliminary tests with red oxide and lime (20–80) against *Botrytis* on lily and *Septoria lycopersici* on tomato gave promising results.

HOFFMANN (W.). **Erfahrungen über Schädlingsbekämpfung in einer grösseren Stadtgartenverwaltung.** [Experiences with pest control in the administration of a large municipal garden.] —*Ratschläge für Haus, Garten, Feld,* vii, 11, pp. 162–164, 1932.

During the last five or six years the writer, in his capacity of municipal head gardener at Elbing [East Prussia], has secured a marked improvement in the health of the plants in the public gardens by the systematic control of diseases and pests. Thus, the severity of finger-and-toe of cabbage [*Plasmodiophora brassicae*] was greatly reduced by the treatment of the seed-beds with uspulun and the immersion of the roots before transplanting in an uspulun-solbar emulsion (one teaspoonful of the former and five of the latter per l. of water mixed with clay) [*R.A.M.*, ix, p. 752], followed by heavy liming. Solbar with an admixture of uspulun (50 gm. per 10 l. of water) has also proved efficacious against tomato canker [*Didymella lycopersici*: ibid., xi, p. 810] and leaf mould [*Cladosporium fulvum*: ibid., x, p. 631; xi, p. 680], the latter likewise yielding to nosprasit 'O' [ibid., xii, p. 32]. The same treatment effectually controlled celery rust [*Septoria apii*: ibid., x, p. 771]. Nosprasit 'O' is stated to have been invaluable in the orchard against the diseases and pests of all kinds of fruit.

**Common names for plant diseases.**—*Trans. Brit. Mycol. Soc.,* xvii, 3, pp. 203–207, 1932.

In this reply to Cunningham's recent paper [*R.A.M.*, xi, p. 386] the Committee for Plant Pathology of the British Mycological Society point out that, in their view, the chief purpose of common names for plant diseases is to provide the practical growers, rather than the plant pathologists, with a designation for each disease, apart from the pathogen, which they can use among themselves and when applying for advice from the specialists. In their opinion, this aim is best attained by basing the name on the most conspicuous outward symptom caused by the disease, provided it is qualified by the name of the host, a principle to which they adhered as much as possible in the list of common names published by them. They welcome Cunningham's suggestion of co-operation with the leading plant pathologists in all parts of the Empire for the purpose of arriving, eventually, at a list of standard names acceptable to all.

BLANK (I. H.). **Modified hanging drop technique.**—*Science,* N.S., lxxvi, 1978, pp. 496–497, 1 diag., 1932.

An improved hanging drop technique, which has been found

very satisfactory for photomicrographic work, has been devised by the writer in connexion with his studies of leather moulds at Cincinnati [*R.A.M.*, xii, p. 94].

A suspension of spores is made in any suitable liquid culture medium, and a drop transferred with an inoculating loop to the centre of a 22 mm. cover-slip. The drop is covered with a 9 mm. cover-slip, and can easily be made large enough to give a uniform film without air bubbles; the large cover-slip, carrying the smaller one, is then inverted and placed over the hollow chamber of a micro-culture slide, the edges being sealed with petrolatum to prevent evaporation of the medium. Using a hollow chamber about 15 mm. in diameter and 3 mm. in depth, sufficient oxygen is available to support normal growth of the spores near the edge of the smaller cover-slip. Only the vegetative hyphae of such moulds as the *Penicillia* and *Aspergilli* remain in the film of medium, the fertile ones growing in the air at the edge of the small cover-slip.

With the aid of this technique it was possible to take a motion picture of mould growth during a five-day period.

TAKAHASHI (W. N.) & RAWLINS (T. E.). **Method for determining shape of colloidal particles: application in study of Tobacco mosaic virus.**—*Proc. Soc. Exper. Biol. and Med.*, xxx, 2, pp. 155–157, 1932.

From a consideration of the principles laid down by Freundlich (Colloid and Capillary Chemistry, 1922) it was expected that, if a sol containing rod-shaped particles were forced from a small glass tube of circular cross section into the same sol contained in a beaker, the orientation of the particles should be the same throughout the stream, all parts of which, therefore, should show double refraction (Ambronn and Frey, Das Polarisationsmikroskop, 1926). If the direction of the flow were reversed and the sol sucked from the beaker through the glass tube, the sol in the beaker should flow radially towards the mouth of the tube as a centre and the long axis of the particles should be oriented parallel to the directions of flow. All regions of the sol in the beaker flowing towards the mouth of the tube would be expected to show double refraction except those flowing parallel to the vibration directions of the crossed nicols. A dark cross should, therefore, be observed in the doubly refractive sol flowing towards the mouth of the tube.

An attempt was made to determine the shape of the tobacco mosaic virus particles by the use of this method. Suspensions of the virus were found to show double refraction throughout the stream when forced from a small tube, the same phenomenon with the addition of a dark cross being observed in the opposite direction. Juice from healthy plants presented no double refraction when travelling in either direction. The experiment was repeated a number of times with juice from different portions of tobacco plants and with tomato plants infected by the same virus, always with identical results in regard to double refraction. Evidently, therefore, the tobacco mosaic virus, or some substance regularly associated with it, is composed of rod-shaped particles.

Chalaud (G.). **Mycorhizes et tubérisation chez Sewardiella tuberifera Kashyap.** [Mycorrhiza and tuberization in *Sewardiella tuberifera* Kashyap.]—*Ann. Bryol.* (Year-Book), v, pp. 1–16, 17 figs., 1932.

The endophyte of *Sewardiella tuberifera*, a tuber-bearing member of the Hepaticae from India [cf. *R.A.M.*, v, p. 48], is stated to belong to the type already known in the European species of *Fegatella* [see next abstract], *Pellia*, and *Fossombronia*. The irregularly swollen, non-septate mycelial hyphae, measuring 2 to 7 $\mu$ in diameter, penetrate the rhizoids of the gametophyte. Arbuscules are of rare occurrence and ill defined, but sporangioles and thick-walled vesicles are numerous; the latter organs contain when young a dense protoplasm with a great number of small nuclei, and were twice observed to contain well-developed, small, unicellular spores with one or two oil drops in each, while three others were occupied by fragments of non-septate hyphae possibly resulting from spore germination. The endophyte passes to the gametophytes formed each year in succession by the growing point; the bulb itself, however, is not invaded.

Bergamaschi (Maria). **Contributo allo studio dei funghi endofiti di Epatiche.** [A contribution to the study of the endophytic fungi of Hepaticae.]—*Atti Ist. Bot. R. Univ. di Pavia*, Ser. IV[a], iii, pp. 185–221, 11 figs., 1932.

The author gives an extensive survey of the literature on the endophytes of the Hepaticae and describes the localization and characters of the fungus found in the thalloids of *Fegatella conica* growing in the province of Pavia [cf. preceding abstract]. The hyphae are hyaline, non-septate, and coralloid, resembling those of a Phycomycete. They invade the rhizoids and pass into the underlying cells where they form vesicles. The invaded zone is usually coloured reddish-violet. From the invaded plants the author isolated a *Mucor* resembling *M. rhizophilus*, a *Fusarium*, and a *Cephalosporium*. The *Mucor* when inoculated into seedlings of *F. conica* obtained from clean seed and grown aseptically favoured their growth, the uninoculated controls remaining stunted and weak.

*Lunularia cruciata* was similarly found to be invaded by an endophyte which enters by the rhizoids but was not observed to form vesicles. Isolations yielded various fungi, none of which was obtained with sufficient frequency to suggest that it might be the endophyte. No species of *Mucor* was obtained from this host.

Brown (A. M.). **Diploidisation of haploid by diploid mycelium of Puccinia helianthi Schw.**—*Nature*, cxxx, 3290, p. 777, 1 fig., 1932.

Craigie has shown [*R.A.M.*, vii, p. 477] that *Puccinia helianthi* is heterothallic. In the writer's tests at the Dominion Rust Research Laboratory, Winnipeg, sporidia of the rust were sparsely sown on the upper surface of the first two foliage leaves of sunflower seedlings. From these inoculations arose 49 haploid pustules. At the age of three weeks none of these pustules bore

aecidia. Twelve were then marked for use as controls, and just beside 16 others uredospores of *P. helianthi* were sown. A week later this process was repeated with 12 other pustules, and after a further week uredospores were sown next to the remaining nine. As a result of these inoculations, uredosori (diploid pustules) arose at or very near the margin of each of the 37 haploid pustules. Eight to twelve days after the uredospore inoculations were made, aecidia began to appear on the under side of all the 37 pustules, while none developed on any of the uninoculated controls. Presumably the diploidization of the haploid by the diploid mycelium is effected by successive nuclear divisions and migrations after contact is established.

WHITEHEAD (T.) & CURRIE (J. F.). **Virus diseases in relation to commercial seed Potato production. With a study of the aphid population at selected farms,** by W. M. DAVIES.—*Ann. of Appl. Biol.*, xix, 4, pp. 529–549, 1 map, 1932.

This is a detailed report of the results of the authors' work, started in 1927, for the purpose of testing the possibilities of North Wales for the commercial production of high-yielding potato seed tubers. Of the fifteen farms originally selected under this scheme, eight were successful up to date in maintaining their stocks free from any noticeable increase of virus diseases, three showed a slight increase, and four had to be discarded for various reasons. Replicated trials at the College Farm, Bangor, of mixed seed tubers from the eleven successful farms showed that this material was equal in yield to Scotch 'stock' seed, a finding which was further confirmed by trials in a number of Welsh counties against ordinary T.S. certified Scotch seed.

The evidence collected by Davies indicated that the lack of increase of virus diseases mentioned above was not due to the scarcity or absence of known insect vectors of the diseases, e.g., *Myzus persicae*, nor to a non-infective condition of the aphids present, since representative samples of the insects taken from potato crops in the farms transmitted leaf roll to healthy potato plants under glass; such samples, however, only transmitted the disease when they included *M. persicae*. The accumulated data further suggest that the maintenance of health in the potato stocks was influenced less by the relative abundance of aphids than by the relation between the date of their maximum infestation and the stage of maturity of the potato foliage, since the best success was obtained in those farms where the maximum infestation was delayed and the potato tops died earliest from natural causes or from blight [*Phytophthora infestans*]. The relative movements of the aphids within the potato crops may also play a part in the intensity of spread of the virus disease, and this question is being investigated.

BUTLER (O.) & MURRAY (H. L.). **Effect of nitrate of potash on the vigor and productivity of healthy and leaf-roll Green Mountain Potato plants and their progenies.**—*Journ. Amer. Soc. Agron.*, xxiv, 11, pp. 881–887, 1932.

A detailed account is given of the writers' experiments in New

Hampshire to determine the effect of nitrate of potash on the vigour and yielding capacity of healthy and leaf roll Green Mountain potatoes grown in pots at two different temperatures, 15° and 20° C.

In 1930 ten tubers were bisected longitudinally and the halves grown one at each temperature, a similar lot receiving nitrate of potash at the rate of 15 gm. per pot. At 20° the fertilizer produced no effect during the first 45 days after planting, but at 15° the growth of the treated plants was somewhat retarded, though their colour was a much deeper green than the controls. Leaf roll plants received similar treatment, and in this case there was a delay in growth in the fertilized series at both temperatures, more pronounced at the higher one. The following are the figures for the increase in mean haulm length 53 days after planting at 15°; healthy 94·5 per cent., healthy fertilized 75·1, leaf roll 88·8, and leaf roll fertilized 47·1, the corresponding percentages at 20° being 8·3, 22·2, 3·8, and − 0·11, respectively. In the healthy series the nitrate of potash increased the yield of the plants grown at 15° by 33·5 per cent. and of those at 20° by 18·7 per cent. Treated leaf roll plants at 15° showed an increase of 12·2 per cent., but at 20° there was a loss of 5·2 per cent.

In 1931 one potato of a size to give individual seed pieces, when bisected, of 20 to 25 gm. in weight was taken from the harvest of each pot and the halves grown at the same temperatures as before. The remaining tubers from each pot were planted whole in beds and grown at 15° to ascertain whether any disease transmission had occurred: this test showed that the seed from the healthy plants gave healthy plants in all cases, and that from leaf roll plants diseased plants only.

The bisected tubers from the four groups of plants in the 1930 test gave eight groups in 1931 which were distributed as follows: healthy and leaf roll plants with and without nitrate of potash grown at 15° in both years; the same at 20°; healthy and leaf roll plants with and without nitrate of potash grown at 15° in 1930 and 20° in 1931; and the same grown at 20° in 1930 and 15° in 1931. In the case of the healthy plants the mean length of the haulms 45 days from the date of planting was 1·1 per cent. less in the fertilized than in the unfertilized grown at 15° in both years; 14·2 per cent. less in the group grown at 15° in 1930 and 20° in 1931; 8·2 per cent. less at 20° in both years; and 18·5 per cent. less at 20° in 1930 and 15° in 1931, the corresponding decrease of growth due to fertilization in leaf roll plants being 24·6, 36·6, 29·7, and 24·4 per cent., respectively.

In 1930 the mean haulm length of the unfertilized leaf roll plants grown at 15° was 20·6 per cent. less than in the healthy; in the leaf roll fertilized plants, 25 per cent. less than in the healthy fertilized; while in the plants grown at 20° the differences were 11·5 and 48·9 per cent., respectively. In 1931 the mean haulm length of the unfertilized leaf roll plants at 15° was much affected by the previous history of the plants. In the group grown at 15° in both years it was 27·7 per cent., and in that changed from 20° in 1930 to 15° in 1931, 42·7 per cent. less than that of the healthy plants. Previous history exercised no material

effect, on the other hand, on the unfertilized group grown at 20°, the mean haulm length in the lot changed from 15° in 1930 to 20° in 1931 being 37·7 per cent., and in that kept at 20° in both years, 36 per cent. less than that of the healthy plants. In the case of leaf roll plants receiving nitrate of potash, the mean haulm length was not appreciably affected either by temperature or by the previous history of the plants. The mean haulm length in the fertilized series grown at 15° in both years was 44·9 per cent., in that changed from 20° in 1930 to 15° in 1931, 46·8 per cent., in the series grown at 15° in 1930 and 20° in 1931, 50·1 per cent., and in that kept at 20° in both years, 51 per cent. less than that of healthy plants.

The leaf roll plants grown at 15° in 1930 yielded 42·2 per cent. less than healthy ones at the same temperature, the corresponding figure for 1931 being 49·3 per cent. Leaf roll plants receiving potash and grown at 15° gave 22·1 per cent. less yield in 1930 than healthy, unfertilized plants and 68·3 per cent. less in 1931. Leaf roll plants grown at 20° in 1930 yielded 24·4 per cent. less than healthy ones at 15° and 60·1 per cent. less in 1931. Leaf roll plants receiving nitrate of potash in 1930 yielded 30·2 per cent. less than healthy, non-fertilized plants at 15° and 76·4 per cent. less in 1931.

These data are considered to be of interest in connexion with Wartenberg's theory that potato degeneration under German conditions may result from the excessive use of potash fertilizers [*R.A.M.*, x, p. 542].

KRÜGER (K.). **Beiträge zur Physiologie der Blattrollkrankheit der Kartoffel.** [Contributions to the physiology of the leaf roll disease of the Potato.]—*Arch. für Pflanzenbau*, A, ix, 3, pp. 496–524, 3 figs., 4 diags., 1932.

A comprehensive account is given of the writer's studies at Landsberg a. d. Warthe on the physiology of potato leaf roll, the investigations of Schweizer [*R.A.M.*, x, p. 332] and other workers on which are summarized and discussed in the opening section of the paper.

A comparative study was carried out on the connexion between the disappearance of starch and the water content in healthy and leaf roll potatoes. It was shown by comparative transpiration measurements on healthy and diseased plants of the Alma, Gisevius, and Deodara varieties that wilting, rolled leaves at first lose less water than healthy ones, but that sooner or later these values are reversed, the healthy foliage giving off less water than the diseased leaves [cf. ibid., xi, p. 395]. Comparative respiratory measurements indicated greater final intensity in healthy than in diseased leaves [cf. ibid., xi, p. 467], notwithstanding an initial increase of respiratory activity on the part of the latter. This phenomenon appears to be attributable rather to mechanical disturbances than to any lack of respiratory enzymes in the leaf roll plants. Observations of the opening and closing movements of stomata of healthy and diseased plants showed that, with a decreasing water content, the stomata close very much more slowly in leaf roll than in healthy leaves, while on the other hand the

stomata of healthy leaves open more rapidly than those of diseased ones with an increasing water content. The fluids of leaf roll foliage showed a higher degree of acidity than those of healthy ones.

Some indication was obtained of possible benefit to leaf roll plants by the application to the tubers of a saponin (0·3 per cent.) and pepsin (0·5 per cent.) solution, with the addition of 0·2 per cent. bile acid solution. The treatment should be applied to the tubers in the spring, or to the plants in the early stages of growth (before flowering in any case).

RATHSACK (K.) & HURWITZ (S.). **Über das Verhalten von Kartoffelknollen verschiedener Abbaustufen im Alkohol, eine Möglichkeit zur Bestimmung des Abbaugrades? Vorläufige Mitteilung.** [Is the behaviour in alcohol of Potato tubers in varying stages of degeneration a possible standard for the determination of the degree of degeneration? Preliminary note.]—*Fortschr. der Landw.*, vii, 22, pp. 553–558, 1932.

The results are fully tabulated and discussed of preliminary tests at the Berlin Agricultural College to ascertain the amount of water withdrawn from potato tubers after two hours' immersion or longer in an alcohol bath with a view to determining whether this served as an index of the stage of degeneration reached [cf. *R.A.M.*, xi, p. 743]. The varieties used were Parnassia, Erdgold, Preussen, Sickingen, Lembke's Industrie, and Edeltraut. It was found that the amount of water withdrawn from the tubers declined with an increasing tendency to degeneration in the second and third progeny, so that there is evidently a certain correlation between vitality and dehydration capacity. Contrary to expectation, the tubers losing the least water were found to have highest absolute water content, so that the reaction is evidently abnormal.

RANG. **Schorf und Stippigkeit bei Kartoffeln.** [Scab and internal rust spot of Potatoes.]—*Deutsche Landw. Presse*, lix, 48, p. 604, 1932.

Complete control of potato scab [*Actinomyces scabies*] was obtained on an Oldenburg farm in 1931 by fertilizing with calcium cyanamide at the rate of 45 kg. per plot, together with potash and phosphorus in the usual amounts. The control plots without calcium cyanamide showed very heavy damage.

Internal rust spot [*R.A.M.*, xi, p. 670] was prevalent during the last two years, especially on the Erdgold variety. Cultural defects appear to be largely responsible for this disturbance, e.g., cultivation on impermeable soils and the use of fresh or insufficiently rotted stable manure, the latter being a most important factor in the causation of the disease.

PHILIPP (W.). **Starkes Auftreten des Pulverschorfs der Kartoffel 1932.** [A severe outbreak of powdery scab of the Potato 1932.]—*Die kranke Pflanze*, ix, 11–12, pp. 111–112, 2 figs., 1932.

An unusually severe outbreak of powdery scab of potatoes (*Spongospora subterranea*) occurred in Saxony during 1932. The

fungus is particularly liable to develop in mountainous regions, where its growth is promoted by heavy precipitation and low temperatures. Contrary to the usual experience, it was found to tolerate an alkaline soil reaction ($P_H$ 7·1) very well [*R.A.M.*, ix, p. 265]. A number of the most popular commercial varieties were affected, including Ackersegen, Erdgold, Preussen, Magdeburger Blaue, Rosafolia, Juliniere, Goldfink, and Konsum. The most important control measure is soil drainage supplemented by applications of lime to loosen the structure of the soil.

Bonde (R.). **Potato spraying and dusting experiments 1929 to 1931.**—*Maine Agric. Exper. Stat. Bull.* 362, pp. 177–232, 4 pl., 1932.

Further experiments have been conducted in Maine on the spraying and dusting of potatoes [*R.A.M.*, ix, p. 265], the average annual increase of yield from which for the period from 1916 to 1931 is estimated at 29·5 bushels per acre, or about 9 per cent. of the average crop.

In 1929, when late blight [*Phytophthora infestans*] was practically absent, the application of Bordeaux mixture appeared to decrease the yield, whereas in the two succeeding years, which were marked by severe attacks of the fungus, the increase was 75 bushels per acre. There was no appreciable difference in yield in 1930 between plots sprayed with low and high pressure (230 to 300 and 400 to 500 lb. per sq. in., respectively). The yield with the tractor-power machine was higher with 'instant Bordeaux' [ibid., xi, p. 587] than with the standard preparation. Good control of late blight and satisfactory yields were given in 1930 by reduced concentrations of Bordeaux ($2\frac{1}{2}$–$2\frac{1}{2}$–50 and $3\frac{1}{3}$–$3\frac{1}{3}$–50). Copper-lime dust was less effective than Bordeaux mixture containing the same amount of copper (25 lb.) in the control of *P. infestans*. In the eight years from 1922 to 1925 and from 1928 to 1931 dusted plots yielded an average of 8 bushels less per acre than those given Bordeaux mixture.

The increased yields secured by the use of 'instant' as compared with standard Bordeaux, and the facility of preparation of the former, would seem to outweigh the higher cost of materials in many cases. Burgundy mixture also possesses some advantages over Bordeaux, one being the absence of a spray residue on the leaves which facilitates roguing for mosaic. This merit is shared by oxo-Bordeaux [ibid., xi, p. 161].

In 1931 the omission of the late applications (end of August and September) resulted in a reduction of yield from late blight amounting to 86 bushels per acre, or four-fifths as much loss as arose from total neglect of spraying. Disease surveys were made during the latter part of August in 1930 and 1931 in Aroostook County, where 82·5 per cent. of the 670 fields inspected were heavily diseased or dead in the former year and 62 per cent. of 640 in the latter, whereas those in which late blight was properly controlled by five to nine applications remained green until about the middle of August and gave an increased yield of more than a barrel a day after 24th August. Judging by the yield in certain test plots, the losses in the commercial fields of Aroostook must

have amounted to several million bushels per annum, largely owing to the premature cessation of spraying. Promising results have already been obtained by a potato spray service, inaugurated in 1931, the functions of which include the issue of 'spray warnings' and the dissemination of information as to existing disease conditions in the State [cf. ibid., xi, pp. 96, 123; xii, p. 76].

CHONA (B. L.). **The occurrence in England of a Potato wilt disease due to Fusarium oxysporum Schlecht.**—*Trans. Brit. Mycol. Soc.*, xvii, 3, pp. 229–235, 1 pl., 1 graph, 1932.

Isolations from Kerr's Pink potato plants which, late in the season of 1928, presented symptoms of wilt (inrolled and soft leaves) at the South-Eastern Agricultural College, Wye, Kent, yielded a fungus which closely agreed in its morphology and cultural characters with a strain of *Fusarium oxysporum* [*R.A.M.*, x, p. 642] obtained from Holland, and which was identified by Wollenweber as *F. euoxysporum* Wr. (= *F. oxysporum* Schlecht.). The pathogenicity of the organism to growing potato plants of the same variety was proved by inoculation experiments [details of which are given], in which it produced symptoms similar to those observed in nature. It was also shown to be able to attack potato tubers in storage, but at ordinary temperatures its rotting activity was much less than that of *F. coeruleum* [ibid., vii, pp. 261, 466, 739 *et passim*]. This is believed to be the first record of the wilt disease of potatoes caused by *F. oxysporum* in Great Britain.

FOSTER (W. R.) & MACLEOD (H. S.). **A new stem-end rot of Potato.**—*Canadian Journ. of Res.*, vii, 5, pp. 520–523, 1 pl., 1 graph, 1932.

Inoculations with monospore cultures of the newly described potato parasite, *Phomopsis tuberivora* [*R.A.M.*, xi, p. 671], on wounded and unwounded tubers of Irish Cobbler, Green Mountain, Early Ohio, and Bliss Triumph potatoes in British Columbia led to the development of typical symptoms of the stem-end rot caused by this organism. The optimum temperature for the growth of the fungus was found to lie between 20° and 25° C., only slight development occurring at 3·34° to 4·45° (38° to 40° F.), the usual storage temperature for potatoes. The optimum hydrogen-ion concentration for the development of *P. tuberivora* is about $P_H$ 6·5. So far the disease has only been recorded in British Columbia.

JENSEN (H. L.). **Contribution to our knowledge of the Actinomycetales. III. Further observations on the genus Micromonospora.**—*Proc. Linn. Soc. New South Wales*, lvii, 3–4, pp. 173–180, 1 fig., 1932.

Continuing his studies of the Actinomycetales isolated from Australian soils [*R.A.M.*, xi, p. 601], the author gives some details of his investigation of 67 strains of *Micromonospora*, the results of which showed that these organisms exhibit only few morphological and biological differences of any taxonomic value. Certain differences in character of growth on agar media and in physiological properties allowed him, however, to separate them into four species-groups, namely, *M. chalceae* n. comb. (believed to be

probably identical with '*Streptothrix*' *chalceae* Foulerton), *M. fusca* n. sp., *M. parva* n. sp., and *M. coerulea* n. sp., brief English diagnoses of which are given. *M. chalceae*, the type species of the genus, is characterized on dextrose-asparagin-agar by a heavy, compact, raised vegetative mycelium, of delicate non-septate hyphae, 0·3 to 0·8 $\mu$ thick, which do not spread much into the medium. The spores are borne singly on the distal ends of short lateral branches and are round to oval and 1·2 to 1·5 by 1 to 1·2 $\mu$ in diameter. They form a well-developed, moist and glistening, brownish- to greenish-black layer. In liquid media the organism forms small, firm, orange granules or flakes. It hydrolyses starch, liquefies gelatin, and digests milk, mostly after coagulating it. Its optimum temperature for growth is 30° to 35° C., and its thermal death point for the mycelium 70° for two to five minutes, while the spores resisted 80° for one to five minutes. The other three species differ chiefly in cultural characters.

DIXON-STEWART (DOROTHY). **Species of Mortierella isolated from soil.**—*Trans. Brit. Mycol. Soc.*, xvii, 3, pp. 208–220, 8 figs., 1932.

In this paper the author describes and figures four species of *Mortierella* and a variety of *M. isabellina*, all of which were isolated by her, among other soil fungi, from sandy loam in Victoria [*R.A.M.*, viii, p. 129], and which she considers to be new to science. Latin diagnoses of the organisms are given.

SALMON (E. S.) & WARE (W. M.). **The chlorotic disease of the Hop. III.**—*Ann. of Appl. Biol.*, xix, 4, pp. 518–528, 1932.

After stating that in 1931 the chlorotic disease of the hop [*R.A.M.*, xi, p. 539] was recorded on the varieties Fuggle, Early Bird, and Tutsham in three new localities of Worcestershire, the authors describe at length the results of their experiments on the transmission of the disease by grafting in various combinations. The disease was successfully transmitted to the commercial varieties Tutsham, Cobbs, and Mathon, and to three new seedling varieties, namely, M. 45, P. 13, and GG. 45. With one doubtful exception, all the plants of the commercial varieties which were successfully infected also showed symptoms of mosaic [loc. cit.], presumably originating from the Fuggle scions. In three cases, individuals of symptomless mosaic carriers of two varieties, to which the chlorotic disease was transmitted, eventually developed marked symptoms of mosaic, but in an appendix it is pointed out that, since the paper was written, two cases have been observed of a natural appearance of mosaic in plants which hitherto had been symptomless carriers of the disease. Two further instances are recorded of the appearance in scions of chlorotic symptoms in the course of the year in which the scions were grafted to the infected stocks.

FRICKHINGER (H. W.). **Zur Bekämpfung der Hopfenperonospora.** [On the control of the Hop *Peronospora.*]—*Die kranke Pflanze*, ix, 11–12, pp. 117–118, 1932.

The writer was impressed, on a recent tour through the German hop-growing districts, by the urgent necessity of timely spraying

against *Peronospora* [*Pseudoperonospora humuli*: *R.A.M.*, x, p. 622]. From conversations with a number of experienced growers he elicited some information concerning the correct times of application and fungicidal concentrations. In open situations good results were secured by commencing the treatments towards the end of May or early in June, but an earlier beginning should be made in gardens protected from the wind by trees or mountain slopes. Frequent applications at a low concentration (1 to 1·5 per cent.) of Wacker's Bordeaux mixture (copper-lime) [ibid., x, p. 706] are of more value than two or three at a higher strength. It is a mistake to cease spraying after five or six applications, a further two to three being requisite for the complete protection of the plants.

HAMILTON (MARION A.). **On three new virus diseases of Hyoscyamus niger.**—*Ann. of Appl. Biol.*, xix, 4, pp. 550–567, 3 pl., 1932.

This is a detailed account of the author's study of three viruses, termed Hy. II, Hy. III, and Hy. IV, respectively, which she obtained in 1930 and 1931 from henbane (*Hyoscyamus niger*) plants (grown for pharmaceutical purposes in two separate fields in Bedfordshire) presenting symptoms of stunting and necrosis, sometimes accompanied by a deformation and rosette habit of the leaves.

Hy. II was obtained by needle inoculation of the juice of the original diseased plants from one of the fields in 1930 into healthy henbane seedlings. In subsequent inoculation work this virus was shown to produce a transient veinbanding in young henbane leaves, later passing into a dark green, irregular mottling in the older leaves. A similar veinbanding, but persisting throughout the life of the host, was also produced in tobacco. In young *Nicotiana glutinosa* plants Hy. II gave faint veinband symptoms which rapidly disappeared. It never produced symptoms either in tomato seedlings or in any of the potato varieties tested. The virus is transmissible by needle, and to a lesser extent through *Myzus persicae*, between *H. niger*, *N. glutinosa*, and tobacco. It passes an L 1 Chamberland but not an L 3 filter, and it became inactive after immersion for 10 minutes in water at 60° C. or over. No definite intracellular inclusions were observed in the tissues of the leaves, stems, and hairs of the plants inoculated with it.

Hy. III was obtained from the two tomato seedlings which alone were successfully inoculated with the juice from the original diseased plants in 1930, and it was never again recovered from the field. In these two seedlings, the inoculation produced symptoms of extreme stunting with dark coloration, blistering, and deformation of the leaves, the same symptoms appearing again in all tomato seedlings inoculated with it. In *H. niger* and tobacco it caused a violent yellow mosaic with a tendency to broad, dark green bands along the veins, necrosis of the older leaves, and some deaths among the weaker and younger plants, especially during the spring. It also caused disease symptoms [which are briefly described] in *N. glutinosa*, *N. glauca*, *Petunia* sp., and *Datura*

*stramonium*. None of the potato varieties tested was infected by it. This virus is much more infective than Hy. II, and is freely transmissible by the needle, and through *M. persicae* between *H. niger*, *N. glutinosa*, and tobacco; this insect was not able, however, to take it to or from tomato, to which the virus is only transferable by needle. The filterability and resistance to heating of Hy. III are the same as for Hy. II. In clarified diseased plant juice the virus apparently did not survive 24 hours keeping. It formed cell inclusions, similar to aucuba and tobacco mosaic X-bodies, in *H. niger*, tobacco and tomato.

Hy. IV was obtained in 1931 from diseased henbane plants in the second field, distant about a mile from the first. In *H. niger* seedlings it gave an all-over 'pepper-and-salt' mottle, which in some leaves had a tendency to form rings; the latter never became necrotic, but after passage through tomato, the virus gave definite ring necrosis in *H. niger*, and also necrotic symptoms in tobacco. In tomato it gave an all-over mottle similar to potato mosaic in this host, but rather more of a veinband type. In tobacco the symptoms appeared first on the leaf next in order of growth to the one inoculated, and proceeded in this order over the whole plant. The infectivity of clarified juice of Hy. IV from tomato and *H. niger* was apparently unaffected by keeping for 48 hours; it was reduced by heating at 70° C. and almost disappeared at 80°. So far the virus has not been found to cause intracellular inclusions, or to be transmissible by any of the insects tested.

SIBILIA (C.). **Un parassita del Finocchio.** [A parasite of Fennel.] —*Boll. R. Staz. Pat. Veg.*, N.S., xii, 2, pp. 210–235, 10 figs., 1932.

In 1927, fennel (*Foeniculum vulgare*) growing in the vicinity of Rome, especially in gardens where intensive cultivation is practised, became affected by a disease caused by a *Ramularia*. Slight infections were confined to a local yellowing of the leaf blades, petioles, and stems, but in severe attacks the whole plant wilted; on the petioles and stems brown, depressed, elliptical or rectangular spots appeared, covered after a few days by rows of minute blackish dots. The affected parts of the leaf blades became constricted, darkened, and showed numerous black dots.

The hyaline or slightly fuliginous conidiophores were 47 to 55 $\mu$ long, and bore at their extremity one or more hyaline, usually 1-septate, elongated or almost cylindrical conidia, with obtuse ends, either singly or in chains of two or three, arising from a short beak at the extremity of the conidiophore. At maturity the terminal conidia became detached, but others developed, conidium production continuing for a fortnight. The mycelium was usually intercellular and measured 2·35 to 4·75 $\mu$ in diameter.

In culture on various media the fungus gave only sclerotia and conidia, the measurements of the latter averaging 42·4 by 6·5 $\mu$, as against 45·5 by 6·5 $\mu$ in nature.

The fungus is named *R. foeniculi* and a Latin diagnosis is given. It appears to be restricted to fennel. Control should consist in the destruction of diseased material and applications of 0·5 per cent.

Caffaro powder, or 0·1 per cent. uspulun or granosan [see above, p. 214].

Bell (A. F.). **Work of the Division of Pathology.**—*Thirty-second Ann. Rept. Queensland Bureau of Sugar Exper. Stat.*, pp. 46–50, 1932.

A disease of sugar-cane observed by the author in Queensland in 1929 and provisionally termed pseudo-streak has now been identified with the Hawaiian chlorotic streak [*R.A.M.*, xi, p. 4], a disease which also occurs in Java and Porto Rico. No causal organism has been found, and in Queensland the condition is practically confined to the Badila variety. It appears to be readily controllable by hot water treatment of the cuttings intended for planting.

When cuttings from 32 sugar-cane crosses were inoculated at planting with a suspension of *Bacterium albilineans* from three sources the results for a single year showed marked differences in susceptibility (e.g., N.G. 24 × E.K. 28 gave 98 per cent. infected stools as against 0 for N.G. 15 × S.C. 12/4 and P.O.J. 2364 × S.C. 12/4).

Red stripe [*Phytomonas rubrilineans*: ibid., xi, p. 473] on Badila canes is almost completely controllable by early (i.e., autumn) planting.

Dwarf disease [ibid., xi, p. 472] was recorded on one farm in a new locality, but the total number of affected farms fell to eight during the period under review. No causal agent was detected.

Ocfemia (G. O.). **An interesting reaction of a Sugar Cane variety to grass mosaic.**—*Philipp. Agric.*, xxi, 6, pp. 414–419, 2 figs., 1932.

On 2nd January 1932, a sugar-cane stalk (Linabnig variety) showing conspicuous symptoms of grass mosaic [*R.A.M.*, vi, p. 318] in its leaves, was sent to the writer from the Los Baños College of Agriculture. Cankered areas were present on the stalk and the internodes were abnormally short. On 8th January four lateral shoots free from mottling were cut off and the main stalk cut into five parts, the cuttings being tied together, immersed in tap water for 48 hours, and wrapped in a wet cheesecloth to germinate. Ten days later the cuttings were planted in sterilized garden soil.

The plants developing from the apparently healthy lateral shoots were free from mosaic symptoms and altogether more vigorous than those from the main stalk, which showed the typical mottling, but mechanical transmission experiments from the former, carried out by Sein's method [ibid., ix, p. 678] on young, healthy shoots of Mauritius 1900, gave a high percentage of infection, indicating that the virus was present in a latent form in the lateral shoots.

In a final inspection (11th October) of the experimental plot, only 5 out of a total of 29 stools grown from apparently healthy Linabnig stalks showed leaf mottling. The propagation of this tolerant variety may therefore assist in the reduction of mosaic injury in the Philippines.

SEAVER (F. J.), CHARDON (C. E.), & TORO (R. A.). **Supplement to mycology.** *ex* **Scientific survey of Porto Rico and the Virgin Islands.**—*New York Acad. Sci.*, viii, 2, pp. 209–225, 229–240, 1932.

Additions and annotations are made to the list of fungi of Porto Rico and the Virgin Islands published in December, 1926, and a bibliography of 220 titles is appended. The total number of fungi, including Myxomycetes, now known to occur in this area is about 1610. The following are some of the records of interest, in addition to those already noticed from other sources. *Phytophthora capsici* has been found in Porto Rico on *Capsicum frutescens* seedlings [*R.A.M.*, xi, p. 803]. *Pythium aphanidermatum* has been found on papaws, and *P. graminicolum* on sugarcane [ibid., xi, p. 540]. *Gibberella moniliformis* has been found (with its imperfect form *Fusarium moniliforme*) causing a wilt of coffee seedlings in Porto Rico; *Pleocyta sacchari* (syn. *Melanconium sacchari*) on dead and dying sugar-cane; *Steirochaete capsici* (syn. *Vermicularia* [*Colletotrichum*] *capsici*) on chilli pepper [ibid., xi, p. 804]; *Sporotrichum mansoni* (syn. *Cladosporium mansoni*) causing a human skin disease, black ringworm [ibid., x, p. 105]; *Acrothecium capsici* on chilli pepper; and *F. batatatis vanillae* on vanilla.

KERN (F. D.). **Supplement to Uredinales.** *ex* **Scientific survey of Porto Rico and the Virgin Islands.**—*New York. Acad. Sci.*, viii, 2, pp. 226–227, 1932.

Eleven rusts are here added to the list already published in 1926, bringing the total number known in Porto Rico and the Virgin Islands to 189. *Uromyces arachidis* (Speg.) P. Henn. on groundnut should be referred to *Puccinia arachidis* Speg. [*R.A.M.*, x, p. 501].

CURZI (M.). **De fungis et morbis africanis. I. De quibusdam hyphomycetibus parasitis Somaliae.** [Of African fungi and diseases. I. Concerning certain parasitic Hyphomycetes from Italian Somaliland.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 2, pp. 149–168, 3 pl., 6 figs., 1932.

A new genus, *Cercodeuterospora* Curzi, is established for a parasite of pigeon pea (*Cajanus indicus*) from Somaliland. It is characterized by undifferentiated, hyaline, fertile hyphae, which emerge from the stomata and branch over the surface of the leaf, thickening irregularly in places and assuming a dark olivaceous or fuliginous tint. From these hyphae small lateral branches are produced, usually one from each cell. These become septate and are released from the mother-hyphae as conidia resembling those of *Cercospora* in shape but less regular in form and less differentiated from the ordinary hyphae. They often appear as simple, lateral mycelial branches which become detached, and the main hyphae also show a tendency to fragment into spore-like segments.

The new species, which is named *C. trichophila* Curzi, produces angular, often confluent spots on the leaves, limited by the veins, 1 to 2 mm. broad, light tawny on the upper surface, drab on the lower and giving the leaf a mosaic appearance. The mycelium in the leaf is hyaline, septate, and 2 to 2·3 $\mu$ in diameter, while after

emergence on the under surface it becomes olivaceous or faintly fuliginous, and is 2 to 8 $\mu$ in diameter. The elongated-obclavate, straight or curved, single, sparse, faintly olivaceous, frequently 2- to 4-septate conidia measure 20 to 50 by 3 to 4 $\mu$, and arise only on one side of the hyphae.

*Cercospora italica* Curzi n. sp. on the leaves of the kapok tree *Ceiba pentandra* [*Eriodendrodron anfractuosum*] produces indeterminate, tobacco-coloured spots 1 to 5 mm. in diameter. The pale olivaceous, pluriseptate conidiophores arise on the under surface singly or in clusters from prominent stromata, are alternately branched, occasionally thickened locally, and measure 30 to 40 by 3 to 4 $\mu$. The subcylindrical, olivaceous, straight or curved conidia are 3- to 6-septate, not or very slightly constricted, tapering at both ends, and measure 35 to 55 by 2·5 to 3·75 $\mu$. So far as the author is aware this is the only *Cercospora* recorded on *E. anfractuosum*.

*C. somalenis* Curzi n. sp. on the leaves of *Cassia fistula* produces sparse, irregular, amphigenous, dark chestnut spots with a blackish-purple margin surrounded by a pale zone. On the lower surface of the leaf dense tufts, 20 to 50 $\mu$ in diameter, arise from a noduliform basal stroma. The simple, erect, continuous, olivaceous conidiophores are sometimes septate, frequently tapering and pale at the apex, and measure 8 to 15 by 2·75 to 3·5 $\mu$. The conidia, at first hyaline, continuous, and ellipsoidal, are later elongated, subcylindrical, 2- to 6-septate, olivaceous, tapering at both ends, and measure 20 to 42 by 2·5 to 3 $\mu$.

*C. sesami* Zimm. var. *somalensis* Curzi n. v. on the leaves of *Sesamum indicum* produces sparse spots 0·5 to 5 mm. in diameter. At first they are minute, sub-rotund, with a whitish centre surrounded by a blackish-purple margin, later they become larger, angular, and distinctly zonate with alternately whitish and blackish-purple circles. The amphigenous, chestnut, dimorphous conidiophores arise from prominent stromata in small bundles or singly; on the upper surface of the leaf they usually arise in tufts and are conspicuously thickened at the base and tapering or geniculated at the apex; non-septate or sparsely septate, and measuring 27 to 40 by 3 to 7 $\mu$. On the under surface they arise singly or in bundles of two or four, and are straight, septate, and frequently 3 to 4 $\mu$ in diameter. The straight or flexuous, cylindrical, hyaline conidia are 5- to 6-septate and measure 40 to 70 by 3 to 3·5 $\mu$.

*C.* [*Cercosporina*] *ricinella* was present on the leaves of *Ricinus communis*. On tobacco leaves *Cercospora nicotianae* produced sparse spots 3 to 8 mm. (sometimes reaching 1 cm.) in diameter. Some of the conidia were bifurcated at the tip, while others had a short lateral stalk protruding 4 to 6 $\mu$ from near the basal scar.

TAI (F. L.). **Notes on Chinese fungi. I.**—*Nanking Journ.*, ii, 171–179, 23 figs., 1932.

An annotated list is given of 18 Chinese fungi [cf. *R.A.M.*, xi, p. 674] of which the following may be mentioned. *Shiraia bambusicola* forms a tuber-like, hemispherical stroma on the leaf sheath of bamboo (*Phyllostachys* sp.), pinkish-buff on the outside and

spinel-red inside (Ridgway's Color Standards), 1·5 to 2·5 cm. long by 1 to 1·5 cm. high.

*Puccinia pruni-persicae*, the uredospores of which were found to differ considerably from Hori's description (*Phytopath.*, ii, p. 144, 1912) in being pale brown, echinulate, subglobose to obovate, 19 to 28·5 by 14·4 to 19 $\mu$ in diameter and with numerous hyaline, capitate paraphyses, has been observed on peaches. *P. fagopyri* Barclay occurs on *Fagopyrum esculentum*.

Sorghum is attacked by *Titaeospora andropogonis* (Miura): syn. *Ramulispora andropogonis* Miura (*S. Manchuria Agric. Bull.*, xi, p. 43, 1920), which is an important parasite of the crop in China. It forms oblong or irregular, red-bordered spots on the leaves. In July the centres of the lesions become greyish and powdery from the development of the conidial stage of the fungus, and in September small, black, hemispherical bodies develop. The conidiophores of the fungus are fasciculate, subnodose, non-septate, with or without branches, hyaline, 20·4 to 32·3 by 2·04 to 2·89 $\mu$, and the conidia filiform, with 2 or 3 branches up to 50 $\mu$ long, hyaline, curved, 47·6 to 106·9 by 2·04 to 3·06 $\mu$ in diameter, and 5- to 11-septate (mostly the former).

MENDOZA (J. M.). **The Philippine species of Parasterina.**—*Philipp. Journ. of Sci.*, xlix, 3, pp. 443–459, 14 pl., 1932.

The writer lists 16 species of Philippine *Parasterina*, several of which are transferred from *Asterina* to *Parasterina* as they were found to be paraphysate. Two new species are described. English diagnoses are given of all the fungi mentioned, a key and a host index to the species also being furnished.

PARK (M.). **Tuber zeylanicum B. & Br. and Sclerotium rolfsii Sacc.**—*Trans. Brit. Mycol. Soc.*, xvii, 3, pp. 179–181, 1 pl., 1932.

In referring to Petch's recent note on *Tuber zeylanicum* [*R.A.M.*, x, p. 751], the author states that re-examination of the types and other material in Kew and in Ceylon showed that this organism and *Sclerocystis coremioides* are separate fungi and distinct from *Sclerotium rolfsii*, and that *S. zeylanicum* is identical with *S. rolfsii*, the latter name having priority.

DE JONG (J. K.). **Roode wortelschimmel.** [Red root fungus.]—*De Bergcultures*, vi, 45, p. 1213, 1932.

Attempts to check the extension of the red root fungus [*Ganoderma pseudoferreum*] in Java tea plantations [*R.A.M.*, xi, p. 131] by means of circular trenches 1 m. deep round the centres of infection have not proved uniformly successful, possibly because the spread of the organism is apt to be very diffuse and the extent of its radius of infection correspondingly ill defined. It is also possible that infection may be partially disseminated by spores. Dr. Steinmann recommends the adoption of the trench method only in cases where the infection foci are well marked and the path of the fungus readily traceable.

**Tea-cider—a new drink in Java.**—*Planters' Chron.*, xxvii, 24, p. 609, 1932.

Instructions are given for the preparation of the so-called 'tea-cider' by the inoculation of an ordinary tea infusion plus 10 per cent. sugar with the 'mould' [*Bacterium xylinum* and *Saccharomycodes ludwigii*: *R.A.M.*, xi, p. 676]. This beverage is stated to have gained a wide popularity in Java as a result of the recent propaganda.

Stevens (N. E.). **United States of America: Tobacco downy mildew in 1932.**—*Internat. Bull. of Plant Protect.*, vi, 11, pp. 180–181, 1932.

Downy mildew of tobacco (*Peronospora hyoscyami*) was more widespread and destructive in the United States in 1932 than the preceding year [*R.A.M.*, xi, pp. 9, 806]. In Georgia and North Carolina the shortage of seedlings caused by the disease was so serious as materially to retard planting, while up to 20 per cent. infection was counted on a farm in Lancaster County, Pennsylvania. The fungus made its first appearance at the end of January on two beds of volunteer plants in southern Georgia. During the first week of April it was generally distributed in the tobacco-growing regions of Georgia, Florida, South Carolina, and the coastal districts of North Carolina. Other States affected were Virginia, Maryland, and Pennsylvania. In Florence County, South Carolina, the disease assumed epidemic proportions, destroying up to two-thirds of the plants in a single bed and creating a panic among the growers, while east of Raleigh, North Carolina, about one-third of the seed-beds were badly affected and some severely damaged.

Guba (E. F.). **Tomato diseases in Massachusetts in 1932.**—*Plant Disease Reporter*, xvi, 16, pp. 175–176, 1932. [Mimeographed.]

The tomato crop on fully 90 per cent. of the farms in Massachusetts is stated to have been destroyed by fungous diseases in 1932. In addition to severe infection by early blight (*Alternaria solani*) [*R.A.M.*, xi, p. 355], leaf mould (*Cladosporium fulvum*) [ibid., xi, pp. 409, 561] (to which the Norton variety proved resistant), bacterial canker (*Aplanobacter michiganense*) [ibid., xii, p. 81], and wilt (*Verticillium ovatum*) [ibid., xi, p. 245], the epidemic of downy mildew (*Phytophthora infestans*) on late tomatoes [ibid., xi, p. 78] was more destructive than in any year since 1905. In October the disease was causing immense losses also in the greenhouse crops. The virulence of the fungus is attributed to the protracted heavy rains of August and early September, with warm days and cool nights, conditions that were paralleled at the time of the previous epidemic. The season of 1932 was not conspicuous for outbreaks of potato blight, which appear rather to occur in years of slight tomato downy mildew, thereby confirming the hypothesis of a biological difference between the two strains of *P. infestans* [ibid., vi, p. 583].

Berkeley (G. H.) & Madden (G. O.). **Transmission of streak and mosaic diseases on Tomato through seed.**—*Scient. Agric.*, xiii, 3, pp. 194–197, 1 pl., 1932. [French summary on p. 199.]

After a passing reference to a previous communication by the senior author (Streak diseases of the Tomato.—*25th Ann. Rept. Vegetable Growers' Assoc.*, Ontario, 1929) describing a test which demonstrated the transmissibility of tomato streak [*R.A.M.*, vi, p. 325; ix, p. 433] through seed, the authors give details of further field and greenhouse work which confirmed this finding, extending it also to tomato mosaic. Both diseases were also shown to be transmissible to healthy plants by inoculation with the juice from crushed embryos dissected out of seed produced by diseased plants. It is pointed out, however, that cases of transmission both directly through the seed and by inoculation from diseased seed are relatively rare and uncertain. Using embryos from streak for the inoculation of healthy plants, negative results were obtained three times, and positive twice, while using seed from mosaic plants, although many negative results were also obtained, as much as 66·6 per cent. successful inoculations resulted in some cases. It was shown that the streak and mosaic which resulted from these inoculations are capable of further transmission and are apparently similar to the diseases as they appear in nature.

In view of these results, it is recommended that seed should be selected from plants free from streak and mosaic. The efficacy of this precaution, in conjunction with measures calculated to prevent infection of the plants from outside sources, was well demonstrated by the fact that the authors grew five successive crops of tomatoes without a single case of streak or mosaic, while previously to this their experimental crops always showed considerable mosaic and some streak.

Sengbusch (R. v.) & Loschakowa-Hasenbusch (N.). **Immunitätszüchtung bei Tomaten. Vorläufige Mitteilung über die Züchtung gegen die Braunfleckenkrankheit (Cladosporium fulvum Cooke) resistenter Sorten.** [Breeding for immunity in Tomatoes. Preliminary note on the breeding of varieties resistant to leaf mould (*Cladosporium fulvum* Cooke).]—*Der Züchter*, iv, 11, pp. 257–264, 5 figs., 1932.

An account is given of experiments conducted at the Kaiser Wilhelm Institute for Breeding Research, Müncheberg, Mark Brandenburg, in the development of tomatoes resistant to leaf mould (*Cladosporium fulvum*) [see above, p. 249].

*Solanum racemigerum*, a wild relative of the cultivated tomato with very small fruits, was found to be immune from leaf mould and was accordingly crossed with a number of susceptible commercial varieties. All the $F_1$ progeny of crosses between the wild and cultivated forms were immune (the tests of this generation included Bonny Best, Danish Export, and Tuckswood as the susceptible parent). Only 46 $F_2$ plants (Westlandia × *S. racemigerum*) were available for testing, of which 11 (23·9 per cent.) were susceptible and 35 (76·1 per cent.) immune. The $F_3$ material comprised 6,968 plants from crosses between *S racemigerum* and

Lucullus, Danish Export, Allerfrüheste Freiland [Earliest of All Outdoor], Golden Queen, Tuckswood, and Condine Red, tests on which indicated that 41·36 per cent. were susceptible and 58·64 per cent. immune, the anticipated figures for each group on a simple Mendelian ratio being 37·5 and 62·5 per cent., respectively.

It is considered very probable from these data that the inheritance of immunity from *C. fulvum* was determined by a single dominant factor, so that tomato plants combining this character with desirable commercial qualities (such as large fruits) should be obtainable by crossing on the lines indicated above.

In crosses between the resistant (but not immune) Stirling Castle and susceptible varieties, all the $F_1$ progeny were highly susceptible. Evidently, therefore, the resistance of Stirling Castle, as opposed to the immunity of *S. racemigerum*, is conditioned by recessive factors.

VANINE (S. I.) & KOTCHKINA (Mme E. M.). Методика фитопатологического исследования семян древесных пород. [Methods of pathological investigation of the seeds of arboreal species.]—*Bull. Leningrad Inst. for Controlling Farm and Forest Pests*, 2, pp. 285–297, 3 figs., 1932. [English summary.]

After stressing the importance from the phytopathological standpoint of determining the micro-organic flora present on the seeds of arboreal species, with particular reference to forest trees, the authors describe two methods for this purpose, one which is the usual method of planting out the seed on agar in Petri dishes, and the other consists in washing a given number of the seeds in a determined volume of sterilized water, and plating out a determined volume of the rinsings on agar. The latter method is most suitable for large-sized seeds, such as acorns, chestnuts, and the like, and allows of calculating the total number of fungal spores present in a sample from the number of colonies produced on the agar plates.

RANKIN (W. H.). **Spraying for leaf diseases of shade trees.**—*Proc. Eighth Ann. Meeting Nat. Shade Tree Conf., 1932*, pp. 64–69, 1932.

Attention is drawn to the need for a systematic spraying programme against the leaf and twig diseases of shade trees in the United States, including black leaf spot of elms [*Gnomonia ulmea*: *R.A.M.*, x, p. 632], leaf and twig blight [*G. veneta*] of plane [*Platanus*: ibid., vii, p. 285], horse-chestnut [*Aesculus hippocastanum*] and buckeye [*A. flava* and *A. californica*] leaf blotch [*Guignardia aesculi*: ibid., vi, p. 581], brown leaf spot [? *Gnomonia leptostyla*] of black walnut [*Juglans nigra*] and butternut [*J. cinerea*: ibid., ix, p. 275], leaf and twig blight of willows [*Fusicladium saliciperdum*: ibid., xi, p. 214], and leaf and twig blight [? *Phomopsis juniperovora*] of young juniper and arbor-vitae [*Thuja occidentalis*: ibid., xi, p. 96]. Three applications of Bordeaux mixture should be given well ahead of the critical periods for infection, (a) when the leaves are unfolding, (b) when they are full-sized, and (c) about a fortnight after the second.

LIMING (O. N.). **The Dutch Elm disease in America.**—*Proc. Eighth Ann. Meeting Nat. Shade Tree Conf., 1932*, pp. 111–113, 1932.

No further cases of the Dutch elm disease [*Ceratostomella ulmi*] were detected in the United States up to August 1932 [*R.A.M.*, x, p. 632]. Of the eight cases hitherto reported (four each in 1930 and 1931) seven are at Cleveland and one at Cincinnati (Ohio). The trees in question were severely infected, and attention is drawn to the urgent necessity for prompt removal of diseased individuals and immediate notification of suspected cases in order to check further spread.

ATANASOFF (D.) & MARTINOFF (S.). Загиването на Брѣста. **Ceratostomella ulmi (Schwarz) Buisman—Graphium ulmi Schwarz.** [The Dutch Elm disease *Ceratostomella ulmi* (Schwarz) Buisman—*Graphium ulmi* Schwarz.]—*Yearbook. Univ. of Sofia, Fac. of Agric.*, Sofia, xi, pp. 71–86, 4 figs., 1932. [English summary.]

After giving, from the relevant literature, a brief but comprehensive account of the symptoms, etiology, and distribution of the Dutch elm disease and of the morphology of its causative agent (*Ceratostomella ulmi*) [*R.A.M.*, xii, p. 126], the authors state that the disease reached Bulgaria a few years ago. At present it is of common occurrence in the public parks of Sofia, and has also been recorded throughout south-western and central Bulgaria. It is presumed that the disease spread from Jugo-Slavia, where the senior author saw it generally distributed along the railway from Tzaribrod to Belgrade.

Local observations have confirmed the presence, noted by the Dutch investigators, of coremia and spores of *C. ulmi* in the galleries bored by *Scolytus scolytus* and *S. multistriatus* [loc. cit.], both of which species are widely distributed in Bulgaria, and also the occurrence around the young shoots of small galleries, in which the beetles deposit infective material. The paper terminates with a brief discussion of control measures.

CAMBONIE (L.). **Nos Châtaigniers sont malades : la jaunisse ou maladie des taches de feuilles.** [Our Chestnuts are diseased: the yellowing or leaf spot disease.]—*La Vie Agric. et Rurale*, xxi, 47, p. 336, 1932.

Chestnut trees in Aveyron, France, are stated to have suffered considerable damage during the summer of 1932 from the leaf spot caused by *Phyllosticta maculiformis*, which produces angular, yellow, later brown lesions leading to desiccation, defoliation, and almost total loss of fruit. By the beginning of August the affected trees presented a completely autumnal aspect. Epidemics of *P. maculiformis* are of rare occurrence; one was reported by Prillieux in 1888, involving the entire Massif Central and Périgord. The heavy rains of the current season are thought to have been responsible for the development of the fungus. Control may be effected in nurseries by spraying with a copper-containing preparation, but such measures are of course impracticable on a large scale. The

Rousse and Tounibo varieties are reputed to be resistant to leaf spot, but further investigations on this point are advisable.

GINET (J.). **La bactériose du Noyer.** [Walnut bacteriosis.]—*Journ. d'Agric. Prat.*, N.S., xcvi, 45, pp. 381–383, 2 figs., 1932.

The organism responsible for the walnut blight in the Isère Valley, France, has now been definitely identified as *Pseudomonas* [*Bacterium*] *juglandis* [*R.A.M.*, xi, p. 339]. Leaves, branches, and fruit are all attacked, the vascular tissues of the foliage being the preferred site of infection. The symptoms, however, may easily be overlooked, especially on large trees, since they are confined to the first flushes of leaves. The lesions on the nuts may penetrate right down to the kernel and cause premature shedding which results in a heavy loss of yield, while the quality of the remaining fruit is impaired. Infection begins with the new growth, indicating that the causal organism overwinters on the twigs. The disease is favoured by humidity and is most prevalent on non-grafted trees, the 'bijou' types, and the Mayette or Tullins variety, on which it is reported to have been introduced from France into California in 1907 [ibid., viii, p. 550]. The more vigorous Franquette and Parisienne walnuts are comparatively resistant. Probably the disease has been present for some considerable time in Dauphiné, escaping notice through its resemblance to anthracnose (*Marssonia* [*Marssonina*] *juglandis*) [*Gnomonia leptostyla*: ibid., viii, pp. 322, 614].

H. **Birkenmaser.** [Birch streaking.]—*Forstarchiv*, viii, 22, p. 392, 1 fig., 1932.

The high financial value of 'streaked' or 'grained' birch wood (nearly M. 100 per sq. m. in a lot of Swedish timber known to the writer) is stated not to be generally realized. In the Scandinavian countries this phenomenon is attributed to the so-called 'wisa' disease [*R.A.M.*, ii, p. 349], and attempts are in progress in Finland to grow 'streaked' material from the seed of affected trees. A watch should be kept for the possible occurrence of a similar form of graining in Germany.

BELIAYEFF (I. A.). Фитопатологическое и анатомическое исследование древесины Фисташки (**Pistacia vera L.**). [Phytopathological and anatomical investigation of Pistachio (*Pistacia vera* L.) wood.]—*Bull. Leningrad Inst. for Controlling Farm and Forest Pests*, 3, pp. 89–108, 6 figs., 2 graphs, 1932. [English summary.]

The author points out the considerable economic importance of the pistachio tree (*Pistacia vera*) in Russian Central Asia, where it grows naturally. Besides the valuable pistachio nuts (over 1,700 tons of which, representing a value, at local rates of sale, of some 4 million roubles [nominally £400,000] were collected in 1926 in the two main stands, covering an area of 27,000 hect.), the tree yields a gum which is highly esteemed locally for chewing purposes, as it is considered to have a beneficial effect on the teeth and gums, and which may also be exploited for the production of a substitute for turpentine; and a very much appreciated raspberry-

coloured dye is obtained from leaf galls caused on it by an insect. But the chief potential industrial value of the tree lies in its wood, as its technical qualities [a detailed description of which is given] are very high for joinery and decorative uses, and are only second to those of box-wood.

The only disease of the tree so far recorded in the region is a heart rot caused by *Fomes rimosus* [*R.A.M.*, x, p. 708], the incidence of which in the two main stands was found to be about 60 per cent. of the standing trees. Field observations indicate that infection usually occurs through the stumps of broken branches and twigs, but the possibility of its occurring also through wounds in the bark is not excluded. At first no discoloration is noticeable in the infected wood, but at a later stage whitish-yellow spots, lighter than the normal sapwood, appear. In decaying the wood loses much of its weight and becomes soft to such a degree that it is easily crumbled with the fingers. In the final stage of decay large cavities appear in the wood, lined with loose mycelial mats of a rusty-brown colour, resembling washleather. The hyphae spread chiefly in the resin ducts, from which they pass into the intercellular spaces and enter the vessels of the wood.

DARKER (G. D.). **The Hypodermataceae of conifers.**—*Contrib. Arnold Arboretum*, i, 131 pp., 27 pl., 1932.

The writer discusses the taxonomy and biology of 48 species of Hypodermataceae occurring on conifer needles, 24 species being described as new [with Latin diagnoses], viz., 10 on *Abies*, 3 on *Picea*, and 11 on *Pinus*. One form and one variety are raised to specific rank, namely, *Hypodermella montivaga* f. *concolor* Dearness as *H. concolor*, and *Hypoderma robustum* [*R.A.M.*, vi, p. 450; vii, p. 290] var. *pini* Dearness as *H. pini*. Six species, viz., *Lophodermium gilvum*, *L. australe*, *L. laricis* [ibid., vi, p. 126], *L. lineatum*, *H. namyslowski*, and *Scolecodothis pinicola* are not regarded as valid and are consequently reduced to synonyms as follows: *L. gilvum* = *Naemacyclus niveus*; *L. australe*, *L. laricis*, and *S. pinicola* = *L. pinastri* [ibid., xi, p. 486]; *L. lineatum* and *H. namyslowski* = *H. desmazierii*.

A new genus is created for *H. deformans* Weir, viz., *Elytroderma deformans* (Weir) comb. nov. This fungus attacks various species of *Pinus* in Canada and the United States. In California small trees of *P. jeffreyi* were observed by the writer to have been converted by the organism into loose, flat-topped brooms, with stunted branches and shortened and swollen internodes, while many saplings had succumbed to the attack. *E. deformans* may be distinguished from *Hypodermella medusa* (in which the hysterothecium is very similar) by its bicellular spores.

*Lophodermellina pinastri*, a name based by v. Höhnel on *Lophodermium pinastri*, belongs according to the description and to the specimens so named by v. Höhnel to *L. piceae*.

The imperfect stages of the Hypodermataceae, so far as they have been encountered, are described under each species, but it is pointed out that, with a few exceptions, positive proof of the genetic connexion between the pycnidial and hysterothecial stages is still lacking.

The most destructive species are those capable of completing their life-cycle in one year, e.g., *E. deformans*, *H. sulcigena* [loc. cit.], and *H. concolor*. Portions of needles, entire needles, or groups of needles may be killed and the stems invaded and stimulated to form witches' brooms. *H. limitata* n. sp. and *H. lacrimiformis* n. sp. destroy short sections of the middle portions of individual needles of *P. radiata* in California and *P. attenuata* in California and Oregon, respectively, resulting in the death of the whole tip beyond the killed portion. *H. nervata* n. sp. and *Bifusella faullii* n. sp., on the other hand, usually attack whole needles of *A. balsamea* (in Ontario), and in cases of heavy infection the entire year's growth is destroyed. *H. concolor* causes such severe blighting of *P. banksiana* and *P. contorta* in Canada and the United States that after one or two years of heavy defoliation, the tips of the twigs are killed and the whole branch may die. Defoliation, however, is rarely severe enough to kill a tree except in the case of very young seedlings, while needle casting is also chiefly of importance in the young growth.

Successful inoculation experiments were carried out with *Hypoderma desmazierii* on *P. strobus*, *P. banksiana*, and *P. resinosa*, *Hypodermella laricis* on *Larix laricina*, *H. concolor* on *P. banksiana*, and *H. nervata* on *A. balsamea*. Experiments with *B. faullii* on *A. balsamea* yielded a few doubtfully successful infections.

LIESE (J.). **Zur Biologie der Douglasiennadelschütte.** [On the biology of the leaf fall of Douglas Fir.]—*Zeitschr. für Forst- u. Jagdwesen*, lxiv, 11, pp. 680–693, 1 fig., 2 graphs, 1 map, 1932.

In connexion with a recapitulation of the chief points in the life-history of *Rhabdocline pseudotsugae*, the causal organism of leaf fall of Douglas firs [*Pseudotsuga taxifolia*: *R.A.M.*, xii, pp. 65–67], the writer points out that the fungus cannot develop further on diseased branches cut off before April, so that it is unnecessary to burn the brushwood removed prior to this date. In many cases the infected needles are spontaneously thrown off during the autumn and winter before the fructifications can develop, while even those remaining on the trees do not necessarily produce the perfect stage of the fungus in May.

Observations in the silvicultural area of Chorin [Mark Brandenburg], where Douglas firs from 19 localities in the United States were planted 22 years ago, showed that most of the blue (*glauca*) mountain and grey (*caesia*) intermediate varieties are highly susceptible to leaf fall, whereas the valuable, rapidly growing green [*viridis*] coastal forms have hitherto remained almost or quite immune. Very heavy infection (60·4 per cent.) was recorded on a group of 192 trees that came from the mountains of central Colorado, while the disease occurred also in a more or less severe form on some of those originating in New Mexico, Idaho, and Washington. However, the presence of immune or highly resistant individuals among these groups encourages the hope of successful selection in nurseries and horticultural establishments. No infection occurred on the coastal forms originating from a locality in

Washington 170 to 200 ft. above sea-level, or from two places in California at altitudes of 1,400 and 1,530 ft., respectively.

The immunity of the coastal varieties may be attributed in part to their late development, the buds being still unopened at the period of spore dissemination. The mountain varieties, on the other hand, mature early and their buds open at the time of maximum virulence of the fungus.

The writer has recently succeeded in the artificial inoculation of young (three- to five-year-old) blue and grey Douglas firs, while the occurrence of spontaneous infection on similar trees in a Pomeranian forest has also been observed. Emphasis is laid on the necessity for the exclusive cultivation in Germany of the late maturing green varieties of Douglas fir.

**Legislative and administrative measures. France.**—*Internat. Bull. of Plant Protect.*, vi, 11, pp. 184–185, 1932.

A Decree of 12th October 1932 (cited in the *Journal Officiel de la République Française*, lxiv, 242, pp. 11075–11077, 1932) provides for the reorganization of the French Plant Protection Service [*R.A.M.*, vii, p. 415], the functions of which are defined as comprising: (1) the scientific study of plant diseases and pests, research and experiments with control methods (in co-operation with the Institute of Agronomic Research); (2) the sanitary supervision of plant production, the distribution of knowledge of the treatments to be used, and the practical organization (with the assistance of the State and municipal bodies) of permanent and voluntary defence against diseases and organisms injurious to plants and plant products; (3) the control of the legalized measures for combating plant diseases and pests, the phytosanitary supervision of imports and exports, and the phytosanitary control of the markets, of marks of origin, and of the standardization of products and their packings; and (4) the issue of phytopathological certificates and supervision of the nurseries and the like supplying the products.

A Consultative Committee for Plant Protection is established under the 'Direction de l'Agriculture', its functions to be defined by an Order of the Minister of Agriculture. An Inspector-General of Agriculture appointed by the Minister of Agriculture is responsible for the co-ordination of the different branches of the Service and for their satisfactory working.

**Legislative and administrative measures. Italy.**—*Internat. Bull. of Plant. Protect.*, vi, 11, p. 185, 1932.

A Decree of 5th August, 1932, issued by the Prefect of the province of Catania, Sicily, enforces the excision and burning of any branches of lemon trees affected by the 'mal secco' (*Deuterophoma tracheiphila*) [see above, p. 214] in the communes of Belpasso, Castiglione di Sicilia, Gravina, Misterbianco,釐Paternò, and Tremestieri Etneo. Holders of land bearing diseased trees will be made responsible for the execution of these orders.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
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WOLLENWEBER (H. W.) & RICHTER (H.). **Die Douglasienschütte und ihr Erreger, Rhabdocline pseudotsugae Syd.** [The leaf fall of Douglas Firs and its agent, *Rhabdocline pseudotsugae* Syd.]—*Blumen- und Pflanzenbau*, xlvii, 11, pp. 167–168, 1 fig., 1932.

This is a condensed version of the writers' paper on the leaf fall of Douglas firs (*Pseudotsuga taxifolia*) caused by *Rhabdocline pseudotsugae* in Germany, a notice of which has already appeared [*R.A.M.*, xii, p. 66].

VANINE (S. I.). Материалы по изучению окраски древесины, вызываемой грибами н химическими причинами. [Contribution to the study of discoloration in timber caused by fungi or chemical agents.]—*Bull. Leningrad Inst. for Controlling Farm and Forest Pests*, 3, pp. 3–37, 11 figs., 1932. [English summary.]

After a brief reference to the economic importance of the various discolorations which occur in felled timber (blue stain [*R.A.M.*, xi, p. 616] alone being responsible for some 1,500,000 roubles' [nominally £150,000] annual losses to the Soviet timber export industry), the author gives short Russian diagnoses of 70 species of fungi belonging to several families which cause such discolorations without affecting the technical qualities of the wood, and which are subdivided by the colour of the stain caused by them. This is followed by an annotated list of six wood-rotting Basidiomycetes which cause different discolorations in the initial stages of their development, and which are also grouped by the colour of the stain produced. A few notes are also given on the discolorations of wood caused by certain chemical agents, among which an interesting case is cited, in which pine boards were superficially stained yellow by the fumes emanating from aniline spilt in the hold of the steamer transporting the boards; the discoloration was removed by treating the boards with ammonia.

MILLER (V. V.). Вопросы биологии и диагностики домовых грибов. **I.** Процесс гниения древесины как источник ее самоувлажнения. **II.** О диагностике домовых грибов в бесплодном состоянии. [Points in the biology and diagnosis of house fungi. I. The rotting process as a source of self-wetting

for timber. II. Diagnosis of house fungi in their sterile stage.]—Pamphlet issued by *State Forestal Technical Publishing Office*, Leningrad, 40 pp., 1932.

In the first part of this paper the author describes at length controlled experiments with *Merulius lacrymans, Poria vaporaria,* and *Coniophora cerebella,* the results of which showed that the amount of free water formed by them in breaking down wood cellulose varied but little, and well within the limits of experimental error, from the theoretical amount (55·55 per cent. of the dry weight of cellulose) calculated from the equation

$$\frac{C_6H_{10}O_5}{162} + \frac{6O_2}{192} = \frac{5H_2O}{90} + \frac{6CO_2}{264}$$

which represents the degradation of cellulose to water and carbon dioxide by the fungi. The importance of the water thus produced as a source of moisture, independent of external supply, in timber rotted by these organisms, or for that matter, by any other cellulose-decomposing fungus, is well illustrated by the fact that it was calculated to amount to 139 l. per 1 c.m. of pine wood rotted to a loss of 50 per cent. of its initial air-dry weight, the specific gravity of the wood being 0·5. To this must also be added the water resulting from the decomposition of pentosans ($C_5H_8O_{10}$), which was computed to amount to 54·54 per cent. of the dry weight of these substances. Further theoretical calculations (confirmed in part experimentally) indicated that, in the absence of evaporation, the intrinsic humidity of the wood should increase as the dry weight is reduced by rotting, but at a considerably higher rate, and that the accumulation of water should occur the more rapidly the higher is the initial moisture content of the wood. Thus, if for an initial water content of 20 per cent. the humidity is increased 21 times for a loss of 55 to 60 per cent. of the dry weight, in timber with 80 per cent. initial moisture, the humidity should be 37·66 times the initial one at the same stage of decay. Experimentally it was established that in flasks, in which an air current was maintained at known rates of flow, the accumulation of water is a function of three main factors, namely, the initial moisture content of the wood, the rapidity of flow of the air, and the rotting energy of the given fungus (calculated in percentages of the dry weight of the wood decomposed per 24 hours). The increase in humidity was checked both by higher air velocities, and when the rotting energy of the fungus sank below a certain minimum. The rotting energy of *M. lacrymans* was found to be correlated with a complex set of environmental conditions, among which the water content of the substratum is an important factor. In flasks in which the wood contained an excess of moisture, the fungus developed inside the substratum very slowly, but produced a very luxuriant aerial mycelium which gave an abundant exudation of water in droplets, with the result that, instead of increasing, the humidity of the substratum was actually found to have been slightly reduced at the end of 63 days. This case leads the author to conceive the possibility that in *M. lacrymans* the function of the aerial mycelium may be twofold, namely, to exhaust excessive humidity from a very moist substratum and thus facili-

tate the progress of the internal mycelium, and, on the other hand, to pave the way for the further progress in space of the fungus by increasing the humidity of the ambient air and by depositing sufficient moisture on the surface of air-dry new wood with which it comes in contact, thus allowing the fungus to get a first foothold on it (the latter was actually proved experimentally). Once established, the fungus becomes independent of any external supply of water, as it can thrive on the water that results from its rotting activity, the more so that it was shown to be much less exigent in its water requirements than the other two fungi. This hypothesis offers a ready explanation for the wetness of the wood rots caused by *M. lacrymans*, as compared to those caused by the other fungi, and also of the fact that it is known to be capable of spreading to a considerable distance in wooden structures, even in the absence of all visible sources of water, without invoking, as previous investigators have done, any water-conducting capacity of its strands. The practical application of the results of the investigation to questions of prevention and control of timber rots, with particular reference to constructional wood, is discussed at some length.

In the second part, the author describes a method for the rapid identification of the sterile mycelia of wood-rotting fungi, based on the fact that the cell walls of both dead and living main, thick-walled hyphae, poor in protoplasm, of *M. lacrymans* and *M. silvester*, are stained metachromatically by certain vital stains, such as neutral red, methylene blue, and toluidin blue, the last-named of which gives the most striking effect, visible even with the naked eye, the cell walls acquiring a rich violet colour. Living protoplasm does not take the stain, but the contents of dead thin-walled hyphae acquire the fundamental colour of the stain, the thin walls remaining practically unstained. In *P. vaporaria* and all the other species of *Poria* which were tested, the cell walls do not take the stain, while the protoplasm is stained the fundamental colour of the stain. In *C. cerebella* the walls of living cells are hardly stained, while those of dead cells take a faint bluish-violet tinge, and the dead protoplasm a dark violet colour. This method, which is claimed to have been successfully used in the author's laboratory for over a year, also gave indications of being useful in the rapid identification of other sterile mycelia, as shown by a few preliminary results which are very briefly discussed. In some cases, members of the same taxonomic genus behaved differently in their reactions to the stain, possibly indicating an incorrect systematic grouping.

Vanine (S. I.) & Vladimirskaya (Mme N. N.). К биологии домовых грибов. [Contribution to the biology of house fungi.]—*Bull. Leningrad Inst. for Controlling Farm and Forest Pests*, 3, pp. 57–74, 4 figs., 1932. [English summary.]

The investigation reported in some detail in this paper was made to throw light on some obscure points in the biology of *Merulius lacrymans* and *Coniophora cerebella*. In mixed cultures of the two fungi on agar, at first the two organisms developed normally, without exerting any visible effect on each other, but when contact between the colonies was reached, *M. lacrymans* had

a depressing effect on the growth of *C. cerebella* (as shown by the latter's mycelium assuming abnormal forms), and finally overgrew it. In wood [species not stated] artificially inoculated with a mixture of the two fungi, the rot produced was very slightly greater (well within the limits of experimental error) than that caused by either fungus singly. *M. lacrymans* was shown not to be able to live in air rarefied to a pressure of 17 mm. mercury; its mycelium lost its viability after 19 days in such an atmosphere, while in air rarefied to 33 mm. its rate of growth was slowed down to half of that in normal air. On the other hand, the growth of *C. cerebella* was not retarded at this rarefaction, and its viability was not affected by 19 days' sojourn in air rarefied to 17 mm. The mycelium of *M. lacrymans* was killed by an exposure of one hour to a temperature of 40° C. or by 20 minutes at 60°, while *C. cerebella* withstood both tests and was only killed at temperatures over 60°. Three hours' exposure to a temperature of − 20° killed *M. lacrymans*, while *C. cerebella* remained viable after the same length of exposure to − 30°.

The embedding in concrete of wood infected with either or both of the fungi did not check the development of the rot. The mycelium of *M. lacrymans* was able to penetrate through the pores in the concrete to a depth of 1 cm., indicating that to protect timber from outside contamination the layer of concrete covering it should be over 1 cm. thick.

Vanine (S. I.) & Vladimirskaya (Mme N. N.). К вопросу о влиянии некоторых засыпок на развитие домовых грибов в древесине построек. [The effect of certain constructional fillings on the development of house fungi in constructional timber.]—*Bull. Leningrad Inst. for Controlling Farm and Forest Pests*, 3, pp. 39–43, 1932. [English summary.]

The results of the experiments briefly reported in this paper showed that of the materials commonly used in Russia to fill in the constructional interspaces in buildings (floors, ceilings, partition walls), clinker [scoriaceous residue from the combustion of coal, coke, and the like] and demolition rubble offer a greater resistance to the penetration of *Merulius lacrymans* and *Coniophora cerebella* from the surrounding timber than earth, clay mixed with straw, or sand. Lime and gravel proved to be practically impenetrable to these fungi, the latter chiefly owing to its very low water-holding capacity. The mycelium of *M. lacrymans* was shown to penetrate the fillings most readily at humidities of the environmental air approaching the saturation point, and a direct relationship was observed between the water-holding capacity of the filling material and its penetrability to either fungus.

Vanine (S. I.), Andreyeff (I. E.), & Sokoloff (D. V.). О влиянии домовых грибов на древесину, окрашенную масляными красками и лаками. [The action of wood-destroying fungi on wood coated with oil paints and varnish.]—*Bull. Leningrad Inst. for Controlling Farm and Forest Pests*, 3, pp. 45–56, 1 fig., 1 graph, 1932. [English summary.]

A brief account is given of controlled experiments, the results

of which [given in the form of tables] showed that pine wood impregnated or coated with creosote was not decayed to any visible extent at the end of three months from its inoculation with *Merulius lacrymans, Coniophora cerebella*, or *Fomes pinicola*. All the commercial oil paints or varnishes tested gave only partial protection against invasion of the wood by these fungi; the samples coated with white lead or zinc white, or with alcohol varnish were considerably less decayed than the others. Subsidiary experiments indicated that the controlling effect of the coatings is not due to any inhibitive action exerted by the paints or varnishes on the development of the fungi, but rather to the fact that they reduce the hygroscopicity of the wood, and also offer a mechanical barrier to the penetration of the organisms. Much of their protective effect depends on the thickness and continuity of the layers in which the paints or varnishes are applied.

VANINE (S. I.), ANDREYEFF (I. E.), VLADIMIRSKAYA (Mme N. N.), & SOKOLOFF (D. V.). Домовые грибы и консервирование древесины. [House fungi and timber preservation.]—Pamphlet issued by *Ленингр. Отд. Всесоюзнаго Инст. Сооружений.* [*Leningrad Branch of Pan-Soviet Inst. for Building*], Leningrad, 80 pp., 23 figs., 2 graphs, 1932.

The first of the three chapters into which this pamphlet is divided opens with an account of experiments, the results of which showed that the external mycelium of *Merulius lacrymans* and *Coniophora cerebella* is killed by 24 hours' exposure to an atmosphere containing 0·0052 gm. acetic acid or 0·033 gm. chlorine, or for one hour to one containing 0·1 gm. chloro-picrin, in 1 l. air. The lethal action of sulphur dioxide and formalin was less pronounced, and such substances as carbon disulphide, benzol, benzine, and sulphuric ether had a still weaker effect on the mycelium. Further tests showed that all these substances diffuse very slightly in a radial direction in dry timber, and only acetic acid and formalin penetrated to a depth of 3 mm.

The remainder of this chapter and the whole of the second reproduce papers by the individual authors on certain points in the biology and activity of the house fungi, the contents of which have been noticed from other sources [see preceding abstracts]. The third chapter deals with the practical side of timber [chiefly pine and fir] impregnation with fungicides.

VLADIMIRSKAYA (Mme N. N.). Разрушаемость камышитов под влиянием жизнедеятельности домовых грибов **Merulius lacrymans Schum.** и **Coniophora cerebella Schr.** [Decay of reed bundles caused by the activity of the house fungi *Merulius lacrymans* Schum. and *Coniophora cerebella* Schr.] —*Bull. Leningrad Inst. for Controlling Farm and Forest Pests*, 3, pp. 75–78, 5 figs., 1932.

After a passing reference to the increasing usage in Russia of reeds tied in bundles as material for filling in constructional interspaces [see preceding page], the author states that in controlled experiments such bundles were readily and completely rotted by *Merulius lacrymans* and *Coniophora cerebella* at high relative

humidities of the environmental air. Soaking the bundles in a 1 or 3 per cent. solution of triolith [*R.A.M.*, xi, p. 85] (the composition of which is stated to be 0·17 per cent. insoluble matter, 1·93 per cent. moisture, 5·12 per cent. chromium calculated as sodium dichromate, 76·86 per cent. sodium fluoride, and 15·93 per cent. organic and other substances), or in 5 per cent. zinc chloride, effectively preserved them from decay, even under optimum conditions for the development of the fungi, but copper sulphate solutions at concentrations as high as 10 per cent. were only partially effective.

HANSEN (H. P.). **Forsøg paa aktiv Immunisering af Kaalroe Brassica napus mod Rhizoctoniose.** [Experiments in the active immunization of Swedes (*Brassica napus*) against rhizoctoniosis.]—*Nordisk Jordbrugsforskning, 1932,* 5, pp. 191–200, 1932. [English summary.]

An experiment was conducted at the Royal Veterinary and Agricultural College, Copenhagen, to determine the practicability of active immunization [cf. *R.A.M.*, xi, p. 529 *et passim*] of swedes (*Brassica napus*) against infection by a strain of *Rhizoctonia* resembling *R.* [*Corticium*] *solani.*

Sterilized swede seeds were placed in Petri dishes on filter paper moistened with nutrients or the substances to be tested. On attaining a length of 2 cm. the seedlings were planted out in infected soil in trays, counts of healthy and diseased plants being made after three and ten days. Some of the seedlings were grown on filter paper moistened with the filtrate of 14-days-old *Rhizoctonia* cultures on 3 per cent. malt extract solution or clean water. Experiments were further carried out to test the effect of the expressed juice of plants grown on filter paper moistened with the fungus-filtrate, as well as of those naturally infected, and of healthy plants.

None of the above-mentioned methods resulted in the immunization of the plants.

A further test demonstrated the necessity of filtering the substratum to be tested through a bacterial filter, treatment of the seedlings with non-sterile expressed juice retarding infection by *Rhizoctonia* as compared with sterile. This is probably due to the antagonistic effect of contaminating organisms. The fungus was found to be capable of growth on sterile filtered expressed juice of seedlings infected by *Rhizoctonia.*

BROWN (J. G.) & EVANS (M. M.). **Two diseases of Peas new to Arizona.**—*Arizona Agric. Exper. Stat. Tech. Bull.* 44, pp. 289–324, 3 pl., 12 figs., 1 graph, 1932.

Dwarf Telephone and Stratagem peas on highly alkaline, heavy loam virgin soil at an altitude of some 4,400 ft. in the Chino Valley, Arizona, were severely attacked in 1930 by a foot rot characterized by death of the roots and stem bases and a more or less extensive yellow or brown discoloration of the leaves. A species of *Fusarium* was isolated from diseased material and inoculated into Premium Gem pea seeds, seedlings, and older plants with positive results. The fungus developed on a number of standard

media, giving a mycelium varying in colour from yellow or brownish to vinaceous or red, and producing true pionnotes of variable dimensions (50 to 52 by 57 to 60 mm. on autoclaved yellow maize meal). The conidial dimensions of six monospore cultures were as follows: 0-septate, 6·8 to 19·5 by 2·3 to 5·5 $\mu$; 1-septate, 10·6 to 31·2 by 2·5 to 5·2 $\mu$; 2-septate, 14·7 to 37·3 by 2·7 to 5·1 $\mu$; 3-septate, 14·4 to 46·5 by 2·7 to 4·8 $\mu$; 4-septate, 25·4 to 46·1 by 2·3 to 4·6 $\mu$; 5-septate, 21·5 to 56·5 by 2·7 to 5·5 $\mu$; and 6-septate, 41·1 to 104 by 3·4 to 11 $\mu$. A few chlamydospores, 7 to 18 $\mu$ in diameter, were observed. The fungus is believed to be a hitherto undescribed variety of *F. merismoides*.

Bacterial blight of peas (*Phytomonas* [*Bacterium*] *pisi*) [*R.A.M.*, xi, p. 700] was observed, for the first time in the State, in the same locality as the foot rot in 1930. The organism was isolated from the diseased field peas and inoculated with positive results into the Canada field variety and the Laxtonian, Stratagem, Dwarf Telephone, and Premium Gem garden peas. Infection is believed to have originated in the seed. The cultural characters of *Bact. pisi* on a number of standard media at hydrogen-ion concentrations ranging from $P_H$ 6·8 to 7·4 are given.

WOODWARD (R. C.). **Cercospora fabae Fautrey, on field Beans.**—*Trans. Brit. Mycol. Soc.*, xvii, 3, pp. 195–202, 1 pl., 1932.

Since 1927, when *Cercospora fabae* was recorded, apparently for the first time in England, on broad beans (*Vicia faba*) in Kent and Oxfordshire [*R.A.M.*, ix, p. 287], the fungus has been found to be widely distributed on the field varieties of *V. faba* over the whole of the country, causing chocolate-coloured spots on the leaves, which closely resemble similar lesions caused by other parasites and frost injury. Conidia of the fungus are not always readily observed on the spots in nature, but when present they may occur in silver-grey sori, situated on dead tissues, or they may occur around the outer circumference of the spots. Under controlled conditions, field bean leaves were readily infected through wounds with mycelium and spores of *C. fabae*, but infection of uninjured leaves was rarely obtained, and such as resulted remained limited and inactive. Parallel inoculation tests with *C. cantuariensis* [ibid., vii, p. 599] showed this fungus to be a very weak wound parasite on the field bean leaves. The experiments also suggested that *C. fabae* may produce black lesions on the stems of field beans in nature.

SIROTINA (Mme M.). Цитологическое изучение мозаики Сахарной Свеклы. [Cytological studies of Sugar Beet mosaic.]—*Науковi Записки з цукрової Промисловости* [*Sugar Industry Scient. Notes*], Kieff, ix [Grey Ser.], 24, pp. 195–216, 10 figs., 1932. [English summary.]

This is a detailed account of the author's cytological study of the leaves of apparently healthy sugar beet plants and of leaves from a small number of plants affected with the 'pointed' [dot], speckled [mottle], reticulate, and $A_3$ mosaics described by Mouravieff [*R.A.M.*, xi, p. 89]. In addition to other structural abnormalities [which are briefly discussed], the only dot mosaic plant examined

showed no differentiation of the mesophyll into palisade and spongy parenchyma, whereas in the other types of mosaic the palisade cells are merely shortened. In all cases the diseased tissues in the early stages of infection showed the presence of intracellular bodies, from simple spindle-shaped to more or less complicated flagellate and sigmoid forms of greatly varying size; such bodies were particularly numerous in the dot mosaic plant. They always were found only in the conducting tissues, never in the mesophyll. The fact, however, that similar bodies were abundantly found in the conducting tissue of the leaves from apparently healthy plants, and that they were absent in some plants exhibiting late acute symptoms of mosaic, throws considerable doubt on their pathological significance.

Other inclusions seen in the epidermal and parenchymatous cells of all the mosaic forms investigated, and occasionally also in the conducting tissue, were in the form of amorphous granular bodies up to 11 by 4 $\mu$ in diameter. In the younger leaves these bodies were usually very minute and in small numbers, and occurred chiefly around the fibro-vascular bundles. As the leaves grew bigger, and coincident with the appearance of the external symptoms of mosaic, the number and size of these bodies increased, and in mature leaves they were very abundant in the epidermis, their accumulation corresponding with the light mosaic spots on the leaves. It was also noticed that the appearance of these bodies usually preceded the development of the external symptoms. In the green areas the bodies were either totally absent or occurred in very small numbers, and they were never seen in apparently healthy plants. Further work is in hand to investigate the nature of these bodies and their causal relationship to sugar beet mosaic.

NIETHAMMER (ANNELIESE). **Die Beizung unseres Gemüsesaatgutes mit Germisan.** [The disinfection of our vegetable seed with germisan.]—*Gartenbauwissensch.*, vi, p. 650, 1932. [Abs. in *Fortschr. der Landw.*, viii, 3, p. 67, 1933.]

The effects of germisan on germination were tested on lettuce, cucumber, spinach, caraway [*Carum carvi*], parsley, and celery seed. The results of the experiments showed that cucumber, spinach, *C. carvi*, and parsley can safely be immersed for half an hour in a 0·125 per cent. solution, whereas lettuce tolerates only 15 minutes. With celery half an hour is probably also safe, but the after-ripening of the seed and germination temperature play an important part requiring further investigation, as is also to some extent the case with spinach and *C. carvi*. Root growth should be carefully watched in experiments of this nature, as it is strongly influenced by seed treatment. As regards disinfection, the method in question proved satisfactory for cucumber, parsley, and celery, partially so for *C. carvi* and spinach, and ineffectual for lettuce.

LUTHRA (J. C.) & BEDI (K. S.). **Some preliminary studies on Gram-blight with reference to its cause and mode of perennation.**—*Indian Journ. Agric. Sci.*, ii, 5, pp. 499–515, 5 pl., 2 graphs, 1932.

The gram (*Cicer arietinum*) crop in the North Punjab has been

heavily damaged by blight, the fungus responsible for which was identified as *Phyllosticta rabiei* [*R.A.M.*, xii, p. 137], notwithstanding its somewhat smaller pycnidia (185 by 155 $\mu$ compared with 200 by 167 $\mu$ for the type species). All the aerial parts of the plants were affected, the stem, branches, petioles, leaflets, and pods bearing brown lesions, the portions above which wilt and bend over. The fungus germinated in 8 to 16 hours in gram seed or leaf extracts at 15°, 20°, and 25° C., but not at 8° to 10° or 32°. Inoculation experiments on *C. arietinum* plants in pots gave positive results after four days. Seeds have been found naturally infected in the pod by *P. rabiei,* which appears to penetrate from the ovary wall into the testa at the point of contact and thence to pass to the cotyledons. The hyaline, branched, septate hyphae of the fungus have been found in and between the cells of the testa and cotyledons. The germinative capacity of the diseased seeds is usually reduced (from 99·3 to 44·6 per cent. in 100 healthy and infected seeds examined), the weight of the latter being only 3·95 as compared with 12·57 gm. Field observations and experiments [which are described] showed that *P. rabiei* is carried on the seed.

VIALA (P.). **Climatologie, viticulture et situation économique en 1932.** [Climatology, viticulture, and the economic situation in 1932.]—*Comptes rendus Acad. d'Agric. de France,* xviii, 29, pp. 966–973, 1932.

The writer states that the vine mildew [*Plasmopara viticola*] epidemic of 1932 in the south-east of France was the most disastrous ever experienced, surpassing even those of 1915, 1928 and 1930 in intensity and rapidity of progress [*R.A.M.*, xi' p. 764; xii, p. 73]. During the wet months of June, July, and September the ravages of the fungus were still further aggravated by the lack of heat and sunlight. At one period fresh attacks of mildew were observed daily for eleven days in succession. Attention is drawn to the very serious financial consequences of the epidemic, especially in small vineyards, and figures are given showing the reduction of yield in a number of localities as compared with 1931.

MANUEL (H. L.). **Bordeaux spray versus dusting powders for the control of Vine diseases.**—*Agric. Gaz. New South Wales,* xliii, 11, pp. 848–850, 1 pl., 1 fig., 1932.

The results of experiments in 1930–1 and 1931–2 confirmed the superiority, already indicated by previous work [*R.A.M.*, x, p. 75], of Bordeaux mixture over dusts in the control of the vine diseases in New South Wales, especially of black spot or anthracnose [*Gloeosporium ampelophagum*]. The cost of dusting is also stated to be much greater per acre than that of spraying under the local conditions.

**Plant diseases.**—*Tenth Ann. Rept. Min. of Agric. Northern Ireland 1930–1931,* pp. 38–41, 1932.

In the section of this report briefly reviewing investigations into plant diseases in progress in Northern Ireland during the period

under review [cf. *R.A.M.*, xi, pp. 396, 413, 746], it is stated that observations indicated that the failure of the oat crop on some farms in County Down in certain seasons may be due to *Helminthosporium avenae* [ibid., ix, p. 225; xii, p. 163]. Leather rot of strawberries (*Phytophthora*) [*cactorum*: ibid., xi, p. 559] was present on one plantation in County Armagh.

VOELKEL [H.] & KLEMM. **Die hauptsächlichsten starken Schäden an Hackfrüchten im Jahre 1932.** [The principal heavy losses in root crops in the year 1932.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xii, 12, pp. 101–103, 5 maps, 1932.

The copious rains of the summer of 1932 caused heavy damage to root crops in Germany. Blackleg of potatoes (*Bacillus phytophthorus*) was widespread in East Prussia and in parts of the central and western districts. Scab (*Actinomyces*) [*scabies*] was responsible for severe damage throughout the country, reductions of yield up to 50 per cent. being reported. The Industrie variety was extensively attacked. Late blight (*Phytophthora infestans*) completely destroyed some of the crops in East Prussia, while elsewhere the losses were also considerable.

Root rot of sugar and fodder beets (*Pythium de Baryanum* and other fungi) was prevalent in north-west Germany, Silesia, and East Prussia; in parts of the last-named province over half the seedlings were attacked, necessitating the ploughing up of the fields. Heart and dry rot [ibid., xii, p. 2] caused heavy losses (up to 50 per cent. of the crop) in Hanover, East Prussia, and Lower Silesia, Saxony ($\frac{1}{5}$ to $\frac{1}{3}$), Westphalia (up to 40 per cent.), and the Rhine Province ($\frac{1}{3}$).

SUNDARARAMAN (S.). **Administration Report of the Mycologist for the year 1931–2.**—17 pp., [? 1933.]

Observations on varietal reaction to blast (*Piricularia oryzae*) [*R.A.M.*, xi, p. 223] in late maturing rices at Coimbatore, Madras, showed that the most susceptible was Korangu samba (A.E.B. 3) which gave 92·48 per cent. diseased tillers, 65 units yield, and 50·77 per cent. chaff; the corresponding figures for Co. 6 being 86·01, 50, and 50; for Adt. 2, 83·92, 50, and 40; for E.B. 24, 2·25, 62, and 29·03; for Co. 1, 6·87, 65, and 38·46; and for Co. 4, 1·22, 43, and 30·23. Eight other varieties tested exhibited an intermediate range of attack.

*Fusarium* foot rot of rice [ibid., xii, p. 11] was very conspicuous on the Garikasannavari variety in the Godavari Delta and on Gobi-kar and Gobi Ayyan samba in Coimbatore. Control consists in seed treatment, only 1·1 per cent. of the plants grown from seed soaked for 30 minutes in 2 per cent. copper sulphate solution becoming affected; seed-bed treatment with 1 per cent. copper sulphate gave 2 per cent. diseased plants, whereas the untreated control plot showed 10·1 per cent. infection. E.B. 24 was absolutely immune, and Kistnakatukulu, Akkulu, Nallarlu, Atragada, and Vankisannam showed commendable resistance.

Sugar-cane mosaic [ibid., xi, p. 223; xii, p. 192] was found to reduce the weight of the cane by at least 10 per cent. (the average weight of one healthy and one diseased cane being, respectively,

1·54 and 1·39 lb.), the percentage of sucrose (from 15·55 to 13·96), and the purity of the juice (glucose increased from 1·14 to 1·47).

Seedling blight (*Colletotrichum*) of Uppam cotton [loc. cit.] was controlled by the use of healthy seed, spraying twice in the seedling stage, wider spacing in sowing, and removing the secondary hosts, *Aristolochia bracteata* and *Hibiscus ficulneus* [*H. diversifolius*]. Saltation yielded four additional strains of the fungus and generally occurred in alkaline media (up to $P_H$ 8) where the depth of the medium was shallow. Infection was favoured by a soil moisture range of 37·5 to 50 per cent. of the water-holding capacity of the soil.

The following hosts (in descending order of susceptibility) were successfully inoculated with *Macrophomina phaseoli*: black gram [*Phaseolus mungo*], green gram [*P. mungo* var. *radiatus*] [ibid., viii, p. 423], French bean [*P. vulgaris*], gingelly [*Sesamum indicum*], mustard, sunflower, niger seed [*Guizotia abyssinica*], jute [ibid., x, p. 613], and sunn hemp [*Crotalaria juncea*]. On Czapek's agar the optimum growth occurred between $P_H$ 4·6 and 6·2 for the gingelly strain and 4 and 6·2 for the black gram strain.

The *Fusarium* identified as *F.* [*oxysporum*] *cubense* [ibid., ix, pp. 64, 730] isolated from wilted bananas gave positive results in artificial inoculations.

'Pollu' disease of pepper [*Piper nigrum*: ibid., ix, p. 87] was caused by the combined attack of *Colletotrichum necator* and the flea-beetle *Longitarsus nigripennis*: in two varieties the percentage of attack in diseased berries averaged 11 for the insect as against 7·5 for the fungus.

*Sclerotium rolfsii* was isolated from wilted ragi (*Eleusine coracana*) and in culture developed aborted fructifications 0·3 to 8 mm. in diameter on the germination of the sclerotia. There was no stalk and the subhymenial layer was composed of a thin layer of tissue, over which was a layer of loose, interwoven hyphae ending in broadened terminal hyphae forming a compact band.

Manns (T. F.) & Adams (J. F.). **Department of Plant Pathology.** —*Ann. Rept. Delaware Agric. Exper. Stat. for the fiscal year ending 30th June, 1932* (*Bull.* 179), pp. 43–55, 2 maps, 1932.

In further tests on the control of tomato seedling diseases carried out in co-operation with Van Haltern at Tifton in Georgia [*R.A.M.*, ix, p. 227], the results indicated that treated seed, plus six applications to the seedlings of Bordeaux mixture (4–4–50) or oxo-Bordeaux (4–50) [ibid., xii, p. 240] as well as treated seed without subsequent spraying gave plants that remained practically free, when transferred from Georgia to Delaware, from the bacterial disease caused by *Aplanobacter michiganense*, which was very severe (47 per cent.) in the plants from the untreated control plot. Subsequently *Alternaria solani* and *Septoria lycopersici* developed slowly on all the plants, though apparently absent from the seedlings when received, thus indicating that both these fungi are spread locally by winds [ibid., x, p. 224].

Tests showed that many common mineral fungicides, such as mercuric chloride and copper sulphate, have little or no power of penetrating deeply into the soil, by which they are quickly

absorbed, but that certain organic substances such as formaldehyde and acetic acid penetrate rapidly and do not seem to become fixed in the top soil.

Infection of young peach leaves with *Bacterium pruni* [ibid., xi, p. 355; xii, p. 145] during the first half of the growing season caused defoliation more rapidly than foliage infections in the latter half of the season. On 16th April, 1931, opening leaf buds were inoculated with five-day-old bouillon cultures of *Bact. pruni*, terminal and lateral buds being exposed to the inoculum by dipping and spraying, so that a heavy load of bacteria was introduced; no infections, however, developed. The first evidence of canker exudations was found on 18th June, 1931.

The [tabulated] results of spraying different apple varieties with various sulphur and copper spray materials and combinations showed interesting variations with one and the same material on different apple varieties in the same block. Evidence was also obtained that the spreader or sticker used with certain sulphur sprays reduced the fungicidal efficiency of the latter. Fish oil (0·5 per cent.) and sodium oleate (0·5 per cent.) increased spore germination of *A. solani* and *Venturia inaequalis*, the former substance giving 91·8 and 77·8 per cent. germination for the two organisms, respectively, and the latter 89·2 and 80·9 per cent., as compared with 59·1 and 55·4 per cent. germination in the controls. They also increased germ-tube growth by 50 to 75 per cent. Two brands of calcium caseinate increased spore germination, but did not accelerate germ-tube growth to the same extent as fish oil or sodium oleate.

Further isolations from infected strawberry roots consistently showed the presence of species of *Actinomyces* [ibid., xi, p. 355], but direct inoculations with the organisms on exposed roots in damp chambers gave negative results.

**Botany and plant pathology section.**—*Ann. Rept. Iowa Agric. Exper. Stat. for the year ending June 30, 1932*, pp. 32–46, 1 fig., 1932.

Further work by C. S. Reddy and E. W. Lindstrom on the resistance of maize to infection by *Basisporium gallarum* [*Nigrospora* sp.: *R.A.M.*, xi, p. 498], using inbreds, $F_1$ crosses, and back-crosses of differentially susceptible lines, showed that resistance is inherited as a dominant character. The correlation between the acidity of the mature cob tissues and resistance to *Nigrospora* still appears to be relatively high, and there were also indications that infection is influenced by the date of planting, growth rate, and hardness of the cob.

I. E. Melhus found that, on land previously under maize, plants from nearly disease-free seed showed 12 per cent. crown infection by *Diplodia zeae* [loc. cit.] compared with 18 per cent. in those from seed inoculated with the fungus. At maturity 80 per cent. of the plants with severe crown infection were invaded to the second internode.

Sixteen physiologic forms of crown rust of oats [*Puccinia lolii*: loc. cit.] were identified by H. C. Murphy among 127 cultures collected in 1931 from the United States, Canada, and Mexico.

Four of these were hitherto unknown in North America, increasing the number of forms identified in that continent from 28 to 32. Physiologic forms 1 and 7 were again the most prevalent. Only three varieties of oats, namely, Bond C.I. No. 2733 (of Australian origin), Victoria C.I. No. 2401, and Glabrota C.I. No. 2630, are resistant to the most common form, the two first-named being resistant to all 32 forms and the first of these to the local forms of loose and covered smut [*Ustilago avenae* and *U. kolleri*], though highly susceptible to stem [black] rust [*P. graminis avenae*]. Hybrids between Bond and certain prolific, black rust-resistant varieties, e.g., Victoria, have been selected in the $F_3$ and $F_4$ generations as homozygous for resistance to all the above-mentioned diseases.

J. J. Wilson made observations on the behaviour of the melon variety Pride of Muscatine (K–S 4) which is resistant to wilt (*Fusarium niveum*) in two infested fields, one of which (No. 1) had been under melons for six consecutive years, while the other (No. 2) had not. On 3rd July, the plants showed 25 per cent. wilt in field No. 1 and 3·2 per cent. in No. 2, the number of deaths on 5th October amounting to 43 per cent. in the former and 11 per cent. in the latter. Among the control (Kleckley Sweet) plants there was 68 per cent. infection on 3rd July [ibid., xii, p. 197].

Under controlled greenhouse conditions S. M. Dietz infected *Chenopodium album, Rumex acetosella, R. crispus, R. altissimus,* and spinach with *Cercospora beticola* [ibid., xi, p. 498], while inoculation tests with *C. davisii* [*C. zebrina*: ibid., ix, p. 319] gave positive results on *Melilotus alba* var. *annua*.

In addition to *Fusarium zonatum* form 1, *Phoma terrestris* was isolated by I. E. Melhus and W. J. Henderson from onion plants suffering from seedling blight and bulb rot [ibid., xi, pp. 162, 421]. The tips of the leaves die and the roots may be found in all stages of decay. Rotting of the bulbs takes place both in the field and during storage.

The virus of yellow dwarf of onions [ibid., xi, p. 760] in sterile distilled water, stored at 29° C., was found by the same investigators to be inactivated after 112 hours, and in diseased leaves, at the same temperature, in 100 hours. The thermal death point of the virus lies between 75° and 80°. Its virulence was not impaired by ten minutes' freezing at −10°. Among the 35 onion varieties tested in the field for three years, the Riverside Sweet Spanish has shown a high degree of tolerance to yellow dwarf. In inoculation tests with diseased onion juice on a number of flowering bulbs and legumes, only the Chinese sacred lily (*Narcissus tazetta* var. *orientalis*) and the true jonquil [*N.*] (*odorus* [var.] *rugulosus*) contracted the yellow dwarf symptoms, which were transferred back to onions from these plants. Most of the Pleasant Valley onion growers have their sets and mother bulbs indexed by members of the Station staff for the presence of yellow dwarf, with the result that the disease is now practically under control.

Good control of damping-off in nine species of conifer seedlings was again given in G. L. McNew's experiments by aluminium sulphate applied to the soil at the rate of up to $1\frac{1}{2}$ oz. per sq. ft. [ibid., ix, p. 8].

Golden or Japanese lily (*Lilium auratum*) bulbs from Japan were rotted in storage by an organism similar to the bread mould, *Monilia sitophila* [ibid., x, p. 501], which also occurred to a lesser extent on *L. speciosum* [vars.] *album* and *rubrum* and on *L. umbellatum*. Effective control was obtained in G. L. McNew's tests by 48 hours' immersion of the bulbs in a mercuric iodide-potassium iodide mixture.

BROWN (J. G.). **Plant pathology.**—*Forty-third Ann. Rept. Arizona Agric. Exper. Stat. for the year ended June 30, 1932*, pp. 109–125, 4 pl., 1932.

During the past decade heavy losses have been caused in Arizona by bacterial rot or slime of lettuce [*R.A.M.*, viii, p. 635], especially among the spring crops exposed to high day and low night temperatures. The microscopic examination of lettuce leaves during periods with a wide daily range of temperature reveals ruptured tissues, the subsequent history of which, however, differs in normal and diseased material. With the latter, the bacteria enter the fissures, multiply, and disorganize the tissues by the wedging action of the bacterial mass, and probably also by the dissolution of the cell walls [cf. ibid., xi, p. 787]. The small, water-soaked spots on the leaves at (or sometimes before) heading time evidently result from stomatal infection. All the commercial lettuce varieties grown in the State appear to be susceptible to bacterial slime.

Several strains of Acala cotton have given promising results in respect of resistance to root rot (*Phymatotrichum omnivorum*) [ibid., viii, p. 240] and productivity. The fungus has been found attacking peach trees at an altitude of 3,500 ft.

An organism apparently identical with *Phytomonas* [*Bacterium*] *tumefaciens* was isolated from tumours up to 9 in. in diameter on *Cupressus arizonica*. Positive results were given by inoculations with it on *Ricinus communis*.

A study of the host range of the causal organism of leaf spot of date palms (*Graphiola phoenicis*) [ibid., xi, p. 572] showed that it is restricted to *Phoenix dactylifera*, the Canary Island palm (*P. canariensis*), and hybrids between the two.

*Cytospora* cankers have been found causing injury to weeping willows [*Salix babylonica*], walnuts, and pecans [*Carya pecan*], the last-named being apparently a new host. The species on pecan is very similar to *C.* [*Valsa*] *nivea* on poplars and cottonwood [*Populus deltoides*: ibid., x, p. 418]. The conidia on pecan range from 3·18 to 5·9 by 0·91 to 2·04 $\mu$ (average 4·38 by 1·17 $\mu$), compared with 3·72 to 5·58 by 0·93 to 1·628 $\mu$ (average 4·77 by 1·32 $\mu$) for *V. nivea* on *P. deltoides*. The latter was successfully inoculated with conidia from pecans. The spore horns of the walnut *Cytospora*, which appears to be associated with insect injury, are brown, whereas on transference to *P. deltoides* they assume an orange tint.

From ulcers in the gizzards of chickens a species of Aspergillaceae differing from *Aspergillus fumigatus* [ibid., ix, p. 184] was isolated. The fungus forms pale pinkish-buff or august-brown colonies on Czapek's solution agar in contrast to the green or nearly black ones

of *A. fumigatus*, and its development is exclusively sexual on all the media hitherto tested, whereas in *A. fumigatus* from poultry mycoses only the conidial stage is produced. On one ranch the loss of young chickens from this disease was 15 to 33 per cent. above the normal. Up to 100 per cent. infection was obtained on healthy chickens by oral inoculations with 5 c.c. of an ascospore suspension of the fungus.

DOWSON (W. J.). **Notes on some bacterial plant diseases in Tasmania.**—*Journ. Pomol. and Hort. Science*, x, 4, pp. 301–305, 1932.

In this paper brief notes are given on four bacterial diseases of cultivated plants in Tasmania, two of which, namely, halo blight (*Bacterium medicaginis* var. *phaseolicola*) [*R.A.M.*, xi, p. 759] of dwarf beans [*Phaseolus vulgaris*] and bacterial spot (*Bact. maculicola*) on cauliflower [ibid., xi, p. 745], were first reported in that State in 1930–1. Walnut blight (*Bact. juglandis*) [ibid., xi, pp. 766, 772] has been known to occur there since 1912, causing considerable annual losses in practically all situations. Mulberry [*Morus* spp.] blight (*Bact. mori*) [ibid., xi, p. 756] was recently reported from a nursery at Hobart and from an orchard in the Spreyton district of northern Tasmania.

MORWOOD (R. B.). **Rust in Wheat.**—*Queensland Agric. Journ.*, xxxviii, 6, pp. 484–487, 1932.

This is a brief, popular account of wheat rusts [*Puccinia graminis* and *P. triticina*] which are stated to be almost invariably present in Queensland, sometimes practically ruining the crops. It is followed by a short discussion of control measures, chiefly by the use of resistant varieties of wheat, but also by early maturing ones which escape the worst attacks of rust. Among the latter, certain hybrids grown by Soutter in Queensland, such as Watchman, Novo, Beewar, and Bobs Indian Pearl Manitoba, are mentioned.

PETIT (A.). **La transmission et le traitement des rouilles des céréales en Tunisie.** [The transmission and treatment of cereal rusts in Tunis.]—*Ann. du Service Bot. et Agron. de Tunisie*, ix, pp. 201–218, 1932.

The writer recapitulates his observations on the transmission of cereal rusts (*Puccinia* spp.) in Tunis, showing that infection is by air-borne uredospores, chiefly from volunteer plants [*R.A.M.*, xi, p. 436], and gives full details of a series of pot experiments in the control of the yellow, brown, and black rusts of wheat (*P. glumarum*, *P. triticina*, and *P. graminis*) by spraying and dusting. The Bump and Hussar varieties were used.

Complete control of yellow rust (the most severe of the three) was given by three dust treatments, viz., non-decyanurized precipitated sulphur, decyanurized precipitated sulphur Codex, and a mixture of 88 per cent. gypsum or lime, with 10 per cent. decyanurized precipitated sulphur, 1 per cent. paraformaldehyde, and 1 per cent. cyanamide. These treatments also reduced the incidence of brown rust, while the last-named was effective against

crown rust of oats [*P. lolii*]. Moderately satisfactory results were given by the following mixtures: 68 per cent. ground sulphur, 30 per cent. copper arsenite, and 2 per cent. saponin; 78 per cent. talc, 20 per cent. copper arsenite, and 2 per cent. saponin; 68 per cent. talc, 30 per cent. copper arsenite, and 2 per cent. saponin; lime or gypsum containing 5 per cent. paraformaldehyde; and 48 per cent. lime, 48 per cent. decyanurized precipitated sulphur, and 4 per cent. formaldehyde. A number of other treatments retarded the appearance of the rusts by a fortnight. Non-decyanurized precipitated sulphur exerted a toxic action on the wheat, as did also the ground sulphur or talc blends with copper arsenite, and ground sulphur-copper carbonate with or without talc. The best adhesive was found to be carbonate of lime. The first treatments should be given ten days before the expected development of the rusts and should be repeated at least twice; during the summer ten applications should be given at six-day intervals. Quite apart from their toxicity to the rusts, the dusts exert a so-called 'screening' effect on the plants, isolating them from environmental influences and thus from contamination by germinating spores [ibid., xii, p. 151].

None of the liquid treatments appeared to be promising.

GASSNER (G.) & STRAIB (W.). **Die Bestimmung der biologischen Rassen des Weizengelbrostes. (Puccinia glumarum f. sp. tritici [Schmidt] Erikss. u. Henn.).** [The determination of the biologic forms of the yellow rust of Wheat (*Puccinia glumarum* f. sp. *tritici* [Schmidt] Erikss. & Henn.).]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xx, 2, pp. 141–163, 1932.

The results [which are fully discussed and tabulated] of inoculation experiments conducted at Brunswick with 17 lines of yellow rust of wheat (*Puccinia glumarum tritici*), comprising 14 biologic forms [*R.A.M.*, xi, p. 166], on numerous (313) varieties of the different *Triticum* groups led to the selection of the following nine *vulgare* varieties for differential purposes: Michigan Amber 29-1-1-1, Vilmorin Blé rouge d'Écosse (var. *milturum*), Strube's Dickkopf (var. *lutescens*), Webster C.I. 3780 (var. *ferrugineum*), Holzapfel's Early, Vilmorin 23, Heine's Kolben, Carsten's Dickkopf V (var. *lutescens*), and Spalding's Prolific (var. *milturum*). These suffice for the differentiation of 10 of the 14 biologic forms, but two supplementary varieties are recommended for the diagnosis of the closely related forms 2 and 3 (Noissy 1929 and Verrières 1930, the former also found at Verrières and Versailles and the latter at Giessen in 1931) and 13 and 14 (Olds, Alberta, Canada, and Jokioinen, Finland); these varieties are Rouge prolifique barbu (var. *ferrugineum*) for 2 and 3 and Chinese 166 (var. *erythrospermum*) for 13 and 14.

Michigan Amber proved highly susceptible to all 14 biologic forms of *P. glumarum* and Vilmorin's Blé rouge d'Écosse to all except 13 and 14. Strube's Dickkopf was highly susceptible to forms 1 to 8 and practically immune from the remaining six. Webster was more or less susceptible to forms 1 to 6, 9, 11, and 13, and Holzapfel's Early severely attacked by 1 to 4 and 9. Vilmorin

23 was susceptible only to forms 1 to 4 (2 and 3 most virulent), Heine's Kolben to 1, 9, and 10, Carsten's V to 5 and 7, while Spalding's Prolific was completely immune from forms 1, 4, 9, and 11 to 14, highly to moderately resistant to 3, 5 to 8, and 10, and susceptible only to 2. These infection types represent the reaction to the rust at a temperature of about 15° C., the plants being kept in diffused light, at a relative atmospheric humidity of 80 per cent., and receiving an adequate nitrogen supply.

GASSNER (G.) & STRAIB (W.). **Über Mutationen in einer biologischen Rasse von Puccinia glumarum tritici (Schmidt) Erikss. und Henn.** [On mutations in a biologic strain of *Puccinia glumarum tritici* (Schmidt) Erikss. and Henn.]—*Zeitschr. Indukt. Abstammungs- und Vererbungslehre*, lxiii, 1–2, pp. 155–180, 1 fig., 2 diags., 1932.

From a monospore culture of the Emersleben strain [form 9: see preceding abstract] of yellow rust of wheat (*Puccinia glumarum tritici*) and its progeny a mutant developed in the ratio of 1·6: 100,000 to 200,000 (approximate) characterized by marked differences in pathogenicity as compared with the parent form. The mutant is provisionally termed 'Neu-Emersleben'. Most of the varieties, especially of the Squarehead type, showing resistance to the Emersleben strain are heavily attacked by the mutant, Carsten's V and Krafft's Dickkopf, however, being exceptions to this rule. Among others resistant to the parent, but susceptible to the mutant, may be mentioned Bensing's Trotzkopf, Beseler's Dickkopf, Hörning's Dickkopf, Mette's Schloss, Pflug's Baltikum, Rimpau's Schlanstedter Dickkopf, Strube's Dickkopf, Svalöf's Panzer, and Vilmorin 23.

The formation of the mutant was observed in 34 cultures and it remained constant for over 30 generations. Its occurrence was first detected in greenhouse experiments at the end of 1930, and in the summer of 1931 it was observed to develop spontaneously in wheat plots at Kleinwanzleben near Magdeburg.

HASSEBRAUK (K.). **Gräserinfektionen mit Getreiderosten.** [Inoculations on grasses with cereal rusts.]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xx, 2, pp. 165–181, 1932.

The writer discusses and tabulates the results of inoculation experiments at Brunswick on 182 grasses of German and foreign origin with one biologic form of each of the following rusts: *Puccinia glumarum tritici*, *P. graminis tritici*, *P. triticina* (all from wheat), *P. dispersa* [*P. secalina*] from rye, *P. simplex* [*P. anomala*] from barley, and *P. coronifera avenae* [*P. lolii*] from oats.

Pustule formation was induced by *P. glumarum tritici* form 4 [see preceding abstracts] on two Phalarideae, one of the Agrostideae, one of the Aveneae (*Gaudinia fragilis*), seven Festuceae (including *Bromus arvensis* and *B. inermis*), and 17 Hordeae, including rye, *Agropyron repens*, *Hordeum jubatum*, *H. maritimum*, and *Elymus* spp.

The biologic form of *P. graminis tritici* used in these tests was marked by its virulence towards the differential wheat varieties, Vernal, Acme, Kubanka, and Little Club, while Kanred, Khapli,

Arnautka, and certain others were immune. It infected one of the Aveneae (*G. fragilis*), 11 Festuceae (including five species of *Bromus*), and 18 Hordeae, including rye, barley, *H. bulbosum*, *H. maritimum*, *H. secalinum*, and *A. repens*.

*P. triticina* form 14 [ibid., viii, p. 366; xii, p. 15] produced positive results on two Aveneae (*Avena nuda* and *G. fragilis*), six Festuceae, and 16 Hordeae, including rye, barley, *H. bulbosum*, *H. maritimum*, *Agropyron*, *Aegilops*, and *Elymus* spp.

A local collection of *P. secalina* infected one of the Festuceae (*B. sterilis*) and seven Hordeae, including *H. maritimum*.

*P. anomala* form 2 [ibid., xi, p. 36] infected *Avena nigra*, *A. strigosa*, *H. bulbosum*, and *H. maritimum*.

A local form of *P. lolii* gave positive results on one of the Phalarideae, six Agrostideae (including *Phleum pratense*), 11 Aveneae (including *Avena fatua*, *A. strigosa*, *Arrhenatherum elatius*, and *G. fragilis*), 15 Festuceae (including *Cynosurus cristatus* and *Dactylis glomerata*), and two Hordeae (*Aegilops cylindrica* and *H. maritimum*).

Considerable differences were observed in the reaction of grasses from different localities to the same biologic form. The results of the author's trials indicate that, in general, the limits of the different biologic forms are by no means so sharply defined as suggested by Eriksson and Klebahn, but that, on the contrary, the host ranges of the various forms are liable in many cases to overlap.

GASSNER (G.) & HASSEBRAUK (K.). **Ueber die Beeinflussung der Rostanfälligkeit durch Eintauchen geimpfter Blätter in Lösungen von Mineralsalzen und anderen Stoffen.** [On the influence on rust susceptibility of the immersion of inoculated leaves in solutions of mineral salts and other substances.]—*Phytopath. Zeitschr.*, v, 4, pp. 323–342, 4 figs., 1 graph, 1933.

The results of experiments in which inoculated wheat leaves were immersed for three to four nights in solutions of mineral salts and certain other substances agreed in the main with those of earlier soil fertilization tests, the outcome of the present trials, however, being even more clear-cut in respect of the modifications in susceptibility to brown rust (*Puccinia triticina* form 14) [see preceding abstract] induced by the different treatments [*R.A.M.*, xi, p. 98; xii, p. 15]. The plants were grown in pots and the green parts immersed during the night by inversion over solution jars with perforated lids.

The resistance of the moderately susceptible v. Rümker's Sommerdickkopf and the susceptible Strube's Dickkopf was greatly augmented by the potassium phosphates (potassium dihydrogen phosphate, dipotassium hydrogen phosphate, and tripotassium phosphate, the first at $\frac{1}{16}$, $\frac{1}{32}$, and $\frac{1}{64}$ mol., the second at $\frac{1}{32}$, $\frac{1}{64}$, and $\frac{1}{128}$ mol., and the third at $\frac{1}{48}$, $\frac{1}{96}$, and $\frac{1}{192}$ mol.) and potassium bicarbonate ($\frac{1}{32}$ mol.). Potassium nitrate caused little increase of resistance, while the effects of potassium sulphate and potassium chloride were intermediate. The resistance of both varieties was further strongly increased by disodium hydrogen phosphate and trisodium phosphate ($\frac{1}{32}$ and $\frac{1}{64}$ mol.).

On the other hand, the susceptibility of v. Rümker's Sommerdickkopf was accentuated by ammonium nitrate, followed in decreasing order by ammonium sulphate, ammonium chloride, urea, glycocol, ammonium phosphate, magnesium nitrate, asparagin, calcium nitrate, potassium nitrate, and sodium nitrate. In a further test it was shown that an increase of susceptibility resulted from the combined application of glucose and ammonium nitrate (10:2 and 15:1 to 1·5 per cent., respectively). The efficacy of the ammonium nitrate solutions was found to depend on the presence of sufficient carbohydrates, larger quantities of the former (1 to 2 per cent.) being tolerated with a simultaneous supply of sugar than when given alone.

The application of these data to the natural occurrence of brown rust is discussed.

DUSSEAU (A.). **Sur le comportement de Triticum haplodurum et des formes issues du même croisement vis-à-vis des différentes maladies du Blé manifestées en 1932.** [On the reaction of *Triticum haplodurum* and of other strains of the same cross to the various Wheat diseases observed in 1932.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 8–9–10, pp. 236–237, 1932.

The type line 1–1 of *Triticum haplodurum* (resulting from a cross of two *T. vulgare* varieties and morphologically resembling *T. durum*, but with a chromosome number of $2n = 14$, relating it to *T. monococcum*) remained in 1932 immune from yellow rust (*Puccinia glumarum*) which was very widespread on other wheats in the valley of the Rhone, and was but slightly attacked by black rust (*P. graminis*), while other lines of the same cross were fairly severely infected by the latter. In the spring its leaves developed a necrotic spotting, isolations from which yielded a *Helminthosporium* and various other fungi; this disease, which was not seen on any other of the numerous wheats grown, is being investigated. In one locality up to three ergot sclerotia (*Claviceps purpurea*) were found per ear in the line 1–2 of *T. haplodurum*, this being stated to be the first record of ergot on wheat in the region of Valence.

CHURCHWARD (J. G.). **The geographic distribution of Tilletia spp. on Wheat in Australia in 1931.**—*Proc. Linn. Soc. New South Wales*, lvii, 5–6, pp. 403–408, 2 maps, 1932.

The results of a survey of the occurrence of wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] in Australia in 1931 showed that both were widely distributed and prevalent in most of the wheat-growing areas; *T. foetens* was the predominating species, excepting in Victoria, where *T. caries* only was collected. The distribution of the two species is shown in two maps.

CLARK (J. A.). **Registration of improved Wheat varieties, VII.**—*Journ. Amer. Soc. Agron.*, xxiv, 12, pp. 975–978, 1932.

Yogo (C.I. No. 8033), a cross between Minturki and Beloglina-Buffum, is a prolific, winter-hardy wheat showing a high degree of resistance to bunt [*Tilletia caries* and *T. foetens*] in five years' trials in Montana (1928–32). The average incidence of infection in

Yogo, Newturk, Karmont, and Turkey was 11·4, 85·7, 100, and 117·1, respectively.

VIENNOT-BOURGIN (G.). **Essais sur la carie du Blé en 1932.** [Studies on Wheat bunt in 1932.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 8–9–10, pp. 257–284, 1 pl., 2 figs., 2 graphs, 1932.

The author describes in some detail the pathological changes observed by him in wheat plants of the Bon Fermier variety (very susceptible to bunt) grown in 1932 at Grignon in soil artificially inoculated with spores of *Tilletia tritici* [*T. caries*: *R.A.M.*, xi, p. 22]. The sowings were made in pots in the laboratory and later the seedlings were transplanted in the field. The results of careful investigation of the diseased plants showed that infection with bunt brought about: (1) a considerable reduction in the number of stems produced by the stools, due to a loss of some 50 per cent. of the tillers more than in the controls, occurring during the vegetative period of growth between the commencement of elongation of the stem and the development of the ears; (2) a reduction in the height of the culms (average 73·85 cm., compared with 126·4 in the controls) due not so much to a shortening of the internodes as to a decrease in their number, with consequent formation of a large number of late-maturing or entirely sterile stems; and (3) a modification in the anatomical structure of the culm. Instead of being quite hollow, the infected internodes were half filled with a fibrillose pith, becoming spongy and soft at the level of the node, and the latter was thickened and contained a large core of pith. While the healthy culm walls are constituted of a very compact sclerenchyma with thick polyhedral cells deeply staining with safranin, a very reduced assimilating parenchyma with small cells, and regularly disposed vascular bundles, in bunted stalks the walls consist of a rather loose sclerenchyma with irregular cells staining very faintly with safranin, and a very reduced assimilating parenchyma made up of very irregular patches of cells of average size, the disposition and number of the vascular bundles remaining unchanged. Comparable changes were also seen in the anatomical structure of the nodes. The general effect of infection is to preserve the wheat stalks in a juvenile, soft condition for an abnormally long period. At the time when the straw changes colour, the diseased spongy tissues of the culms shrink through loss of water, and the leaf sheaths become detached from the stem, depriving the latter of a large measure of support; this, in conjunction with loss of turgidity, leads first to a bending down of the stalks, and later to their breaking, usually at the second node. Infection with bunt also brings about a reduction of the foliage, both through a decrease of the number of leaves and through a stunting of the latter in length and width.

Field observations on the incidence and development of yellow rust (*Puccinia glumarum*) on the bunted wheat plants, together with a few artificial inoculations of such plants with spores of the rust, showed that the diseased plants were more susceptible than the healthy [ibid., x, pp. 479, 589], but the author is inclined to believe that this increase in susceptibility is more apparent than real, and is due chiefly to the fact that, on the one hand, the bunted

plants remain for a longer time in a juvenile state [cf. ibid., xii, p. 211], and on the other, that for the same amount of inoculum the total area of foliage in bunted plants is considerably reduced, this producing an effect of a more intense infection. The chemical composition of the bunted wheat plant may, however, be also modified, as indicated by the fact that samples of bunted stalks preserved in methylated alcohol were deeply and uniformly stained brownish-black, while the colour of normal stalks was somewhat cleared by this treatment. [A summarized account of the author's results is given in *Comptes rendus Acad. d'Agric. de France*, xviii, 34, pp. 1144–1146, 1932.]

HANNA (W. F.). **The odor of bunt spores.**—*Phytopath.*, xxii, 12, pp. 978–979, 1932.

Since the publication of a recent paper by the writer and his collaborators in which the characteristic odour of wheat bunt spores was attributed to the presence of trimethylamine in *Tilletia levis* [*T. foetens*], but not in the single physiologic form of *T. tritici* [*T. caries*] available [*R.A.M.*, xii, p. 156], a faint smell of trimethylamine was detected in spores of the latter smut at the Versailles Station Centrale de Pathologie Végétale. A distinct odour of trimethylamine was further emitted by several forms of *T. caries* from Washington [ibid., x, p. 19]. It is evident, therefore, that trimethylamine may be present in the spores of some strains of *T. caries* and absent from others.

Using pure cultures from single secondary (apparently haploid) conidia, crosses have been made between *T. foetens* and the *T. caries* strain without trimethylamine. The $F_1$ hybrid spores resulting from this cross resemble those of the *T. foetens* parent [ibid., xi, p. 706] and emit an odour of trimethylamine, indicating that the factors for smooth spore wall and smell are dominant.

AAMODT (O. S.) & MALLOCH (J. G.). **'Smutty' Wheat caused by Ustilago utriculosa on Dock-leaved Persicary.**—*Canadian Journ. of Res.*, vii, 6, pp. 578-582, 1 pl., 1932.

The pale or dock-leaved persicary (*Polygonum lapathifolium*) in Alberta was found in September, 1931, to be infected by the loose smut, *Ustilago utriculosa* Nees, not hitherto known to occur in Canada. Diseased plants growing in a wheat field (Garnet variety) were harvested with the grain, which became mechanically infected by the spores in the threshing operation. The wheat thus contaminated appears to be subject to the usual extra cost of handling common to samples infected by bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*: cf. *R.A.M.*, x, p. 716]. The effect of *U. utriculosa* on the loaf colour was similar to that of bunt. I. L. Conners, of the Division of Botany, Ottawa, reports the occurrence of *U. utriculosa* on *P. pennsylvanicum* and *P. persicaria* in New Brunswick and Prince Edward Island, respectively.

RIEHM (E.). **Fusariumkrankheiten des Getreides.** [*Fusarium* diseases of cereals.]—*Deutsche Landw. Presse,* lix, 52, p. 650, 1 col. pl., 1932.

A popular account is given of the *Fusarium* diseases of cereals

in Germany, including snow mould of rye (*Calonectria graminicola*) and the various manifestations of foot rot due to species of this genus [*R.A.M.*, xii, p. 157, and next abstract].

GENTNER (G.). **Schädigung der Keimwurzeln von Roggen und Weizen durch Fusariumbefall.** [Injury to the radicles of Rye and Wheat from *Fusarium* attack.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz*, x, 9–10, pp. 219–222, 1 fig., 1932.

*Fusarium herbarum* is stated to have been responsible for exceptionally heavy damage to rye and wheat in Bavaria in 1932, the incidence of infection on diseased samples of both hosts being over 95 per cent. as compared with 40 to 60 per cent. for the former and 30 to 50 per cent. for the latter in normal seasons [cf. *R.A.M.*, vii, p. 505; x, p. 514]. The very wet weather in July is thought to have favoured the development of the fungus. At low temperatures (8° to 10° C.) the radicles were destroyed by *F. herbarum*, an effect that was largely counteracted in the writer's experiments by seed disinfection with roggenfusariol.

GÄUMANN (E.). **Der Einfluss der Keimungstemperatur auf die chemische Zusammensetzung der Getreidekeimlinge I.** [The influence of the germination temperature on the chemical composition of cereal seedlings I.]—*Zeitschr. für Bot.*, xxv, 8–9, pp. 385–461, 19 graphs, 1932.

In connexion with studies on the influence of germination temperature on the chemical composition of cereal seedlings, the writer found that seedlings of Plantahof, an early ripening, white-, smooth-, and loose-awned Swiss wheat, grown at different germination temperatures, show a relationship between the germination temperature and the solubility of their cell wall substance by *Fusarium herbarum* [see preceding abstract]. A method is described by which it was possible to obtain from the germinating seeds a material free from soluble carbohydrates and starch, and consisting mainly of the cell wall substances. This was tested by exposure to the action of the enzymes of *F. herbarum* obtained by growth in Richards's solution for two to three weeks, trituration of the mycelium, and filtration of the expressed sap with subsequent purification of the enzyme. The cell wall substance of seedlings grown at high temperatures (21° to 23° C.) underwent dissolution half as easily again as that of those developing at 3° to 9°, when exposed to the action of the enzyme at $P_H$ 5·28. The xylan curve (percentage of xylan in the cell wall substance of the seedlings germinating at various temperatures) was found to show a certain similarity with that for the solubility of the cell wall substance under the enzymatic action of *F. herbarum* at corresponding temperatures. The varying degree of solubility of the cell walls formed at different temperatures appears to be dependent on the proportions of the hemicelluloses, especially xylan, in the cell walls.

In a preliminary investigation of the effect of soil temperature on the invasion of wheat seedlings by *Gibberella saubinetii*, the graph of total incidence was shown to rise to a maximum at about

24° and remain there at higher temperatures, whereas the curve for slight infection falls above this point and that for severe infection continues to rise up to the highest temperature tested, 39° [cf. ibid., x, p. 721].

THOENES (H.). **Die Weissährigkeit des Winterweizens.** [The 'white-eared' condition of winter Wheat.]—*Pflanzenbau, Pflanzenschutz u. Pflanzenzucht*, viii, 11, pp. 275–276, 1932.

Exception is taken to Neumann's statement (*Superphosphat*, p. 253, 1931) that the foot rots of wheat (*Ophiobolus* [*graminis* and *O. herpotrichus*] and *Leptosphaeria* [*herpotrichoides*: *R.A.M.*, xii, p. 159]) are readily preventable in Germany by applications before sowing of superphosphate and phosphoric acid. No doubt there have been individual cases of good control by this method, but the whole problem of the foot rots, with their varying manifestations, is too complicated to be thus easily solved. So far no remedy has been found uniformly applicable to all types of this very serious disease.

SPRAGUE (R.). **The influence of moisture on the development of the Cercosporella foot rot of winter cereals.**—Abs. in *Phytopath.*, xxii, 12, pp. 999–1000, 1932.

*Cercosporella herpotrichoides* [*R.A.M.*, xi, p. 503], the agent of a destructive foot rot of winter cereals in the Columbia Basin of Washington and Oregon, occurs in semi-arid prairie regions with an annual rainfall of 14 to 24 in., its optimum development being reached in districts with just below 20 in. Severe infection is favoured by a warm, moist March, followed by an equally moist, cool April and early May, especially when the plants have been forced by prolonged growth the preceding autumn. The disease is prevalent in fine sandy loam soil with plentiful moisture. With the advent of the dry season the drop in the surface soil moisture checks its further development. The soil moisture, which is directly correlated with seasonal precipitation, seems to determine the relative severity of this type of foot rot in different years.

**Zur Frage der Schädigung des Saatgutes durch Trockenbeizen.** [On the question of the injury of seed-grain by disinfectant dusts.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xii, 12, p. 103, 1932.

Rabien's statement that abavit B is injurious to cereal seed-grains kept for ten weeks at a temperature of 0° to 3° C. [*R.A.M.*, xi, p. 773] has been interpreted in certain quarters as reflecting on the merits of this preparation. It is expressly affirmed, therefore, on the authority of the German Plant Protection Service, that abavit B exercises no adverse effect on the germinability of seed-grain maintained under normal temperature conditions. It will, as heretofore, be included in the lists of officially recommended fungicides against wheat bunt [*Tilletia caries* and *T. foetens*], loose smut of oats [*Ustilago avenae*], and snow mould [of rye and other cereals: *Calonectria graminicola*].

VANDERWALLE (R.). **Contribution à l'étude des maladies charbonneuses de l'Orge.** [A contribution to the study of the smut diseases of Barley.]—*Bull. Inst. Agron. et des Stat. de Recherches de Gembloux*, i, 4, pp. 291–322, 4 pl., 1932. [Flemish, German, and English summaries.]

The writer's observations, near Gembloux, Belgium, on the occurrence of loose and covered smuts of barley (*Ustilago nuda* and *U. hordei*) revealed the presence, on plots of the Précoce de Vendée variety, of a distinct late type of the former attacking only the lower part of the ear. In some cases the spikelets affected by this type are bifid, while in others the primary ears of a plant remain intact and the secondary ones are completely smutted.

In greenhouse inoculation experiments on the seed, the ordinary form of *U. nuda* manifested a high degree of virulence, attacking not only the ears, but also the leaves and haulms, on which it produced pulverulent streaks resembling those formed on rye by *Urocystis occulta.* On the other hand, the late form of loose smut produces chlamydospores from mycelial aggregations exclusively in the ear, the symptoms on which recall those of covered smut since the sori are surrounded by a silvery sheath formed by the host tissues. The spores of the late form are intermediate in roughness between the finely echinulate ones of loose smut and the smooth ones of covered smut, and the dimensions in nature of the late form of *U. nuda* are $5{\cdot}28 \pm 0{\cdot}0227$ by $3{\cdot}90 \pm 0{\cdot}347\,\mu$, compared with $6{\cdot}30 \pm 0{\cdot}0245$ by $4{\cdot}73 \pm 0{\cdot}227\,\mu$ for loose smut proper. The corresponding dimensions of the spores resulting from artificial infections carried out under glass were $6{\cdot}83 \pm 0{\cdot}001$ by $6{\cdot}40 \pm 0{\cdot}05\,\mu$ and $6{\cdot}05 \pm 0{\cdot}018$ by $4{\cdot}82 \pm 0{\cdot}0876\,\mu$, the spores of *U. hordei* in similar conditions measuring $5{\cdot}90 \pm 0{\cdot}0067$ by $5{\cdot}42 \pm 0{\cdot}0088\,\mu$. The late form of loose smut is believed to result from natural hybridization between *U. nuda* and *U. hordei.*

The best control of *U. nuda* was given by three hours' immersion of the seed-grain in water at natural temperature followed by 8 to 10 minutes in water heated to 51° to 52° C. Attention is drawn to the possibility of control by two natural enemies of *U. nuda*, viz., a clavicorn insect, *Cartodere filum*, and the fungus *Trichothecium roseum* [*R.A.M.*, x, p. 321 *et passim*], the dense mycelium of which prevents the dissemination of the spores at the base of the spikelets.

GORDON (W. L.) & WELSH (J. N.). **Oat stem rust investigations in Canada.**—*Scient. Agric.*, xiii, 4, pp. 228–235, 1932. [French summary on p. 273.]

This is a summarized account of investigations from 1925 to 1930, inclusive, of the occurrence and distribution in Canada of physiologic forms of the oat stem rust (*Puccinia graminis avenae*) [*R.A.M.*, xi, p. 176; xii, p. 86], the results of which showed the presence in the 1,070 collections of the rust (mostly from western Canada) of six physiologic forms in addition to the three (1, 2, and 5) which were previously known to occur in the Dominion. The latter forms were the most prevalent, accounting for 96·5 per cent. of the total isolations; the other six forms, 3, 4, 6, 7, 8, and 9, were isolated rarely, although all of them were shown to be more viru-

lent than the three first found. An attempt was made to study the physiologic forms by hybridizing them on the barberry [ibid., ix, p. 356]; inoculations with sporidia, however, gave positive results only with form 8, and a study of the cultures thus produced showed the presence in them of forms 6, 7, and 8, indicating the heterozygous nature of the last-named form; a single aecidial cup, however, only yielded one physiologic form.

Some details are also given of breeding work, in which the Heigira Strain oat, resistant to forms 1, 2, 3, 5, and 7, was crossed with higher yielding but susceptible varieties, Banner, Star, and Victory. In the result, fairly high yielding strains were produced, which proved to be resistant to approximately 98 per cent. of all the isolations of physiologic forms of *P. g. avenae* made in Canada during the period under review. The inheritance of the reaction to stem rust of the adult plant in the field is apparently controlled by the same factors that govern the inheritance of the reaction of seedlings in the greenhouse. In a Heigira Strain × Banner cross this inheritance was found to be governed by a single dominant factor.

STEVENS (N. E.). **United States of America: an epidemic of bacterial wilt of Maize.**—*Internat. Bull. of Plant Protect.*, vi, 12, pp. 203–204, 1932.

Bacterial wilt of maize (*Aplanobacter stewarti*), which was unusually severe in many parts of the United States in 1930 and 1931, culminated in 1932 in an epidemic, the intensity and extent of which is probably unparalleled. Certainly this has been the worst attack since Stewart's description of the disease 35 years ago. Notes are given on the incidence of bacterial wilt in a number of north-eastern States [cf. *R.A.M.*, xii, p. 206].

SAVASTANO (G.). **Ricerche sperimentali sul marcio dei frutti degli Agrumi. I. Specie batteriche e fungine isolate ed alcune loro caratteristiche biologiche.** [Experimental researches on rotting of Citrus fruits. I. Bacterial and fungal species isolated and some of their biological characteristics.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 3, pp. 306–340, 7 pl., 2 graphs, 1932.

After briefly discussing the economic aspects of citrus fruit rots as they affect Italian growers, and the factors affecting infection, the author gives a full account of inoculation experiments made on lemons and oranges with numerous organisms which attack these hosts in Sicily.

Inoculations of ripe lemons on the tree and in the laboratory with *Phytomonas* [*Pseudomonas*] *citriputeale* [*R.A.M.*, ix, p. 303] gave positive results in ten days. This organism, which penetrates the fruit only through wounds, causes much damage to hanging fruits in wet weather, especially if the rain is preceded by hail. It is very prevalent in the vicinity of Acireale from February to April.

Sicilian lemons are severely attacked by *Phytophthora citrophthora* [ibid., xii, p. 212], the leaves also being liable to infection. The disease (known locally as 'allupatura') causes less damage in

Sicily than in California (probably because of the higher grafting practised in the former country), but in wet localities it greatly reduces the winter crop.

*Sclerotinia minor* was isolated from fallen lemons near Acireale and from oranges in Catania, this being the first Italian record of the fungus. Inoculations with pieces of diseased tissue and mycelium at 20° to 21° C. caused after 48 hours a softening of the tissues and a slight chestnut discoloration resembling an oil spot. After four days the spots, which had darkened considerably, measured 55 and 42 mm. in diameter on the lemons and oranges, respectively. In culture the fungus formed very minute sclerotia in eight to twelve days. It penetrates unwounded fruit by contact.

Inoculations of oranges and lemons with *S. sclerotiorum* [ibid., x, p. 307], isolated from oranges, rapidly gave positive results. The fungus was found on the twigs of mandarin [*Citrus nobilis* var. *deliciosa*] and lemon at Acireale, and cross-inoculations from fruit to branches and *vice versa* gave positive results, as did inoculations of actively growing, tender lemon shoots. *S. sclerotiorum* has not yet been recorded as parasitic on citrus fruits in Italy, but it has very occasionally been observed in Sicily on fruits which have lain on the ground for some days during wet weather.

*Penicillium digitatum* [ibid., xii, p. 167] is the principal cause of decay among lemons arriving at the London market from Italy throughout the year, and especially from December to May. *P. digitatum* was found to rot a larger area in a given time than any other citrus fruit parasite, causing complete decay of lemons at 18° to 28° in less than four days; *P. italicum* requires ten days to produce the same effect. When the fruit is attacked by *P. digitatum* the paper wrapping is stuck to the skin and can be removed only in bits, whereas in infection by *P. italicum*, whatever its degree, the paper is easily removable without tearing. *P. italicum* prepares the way for the other species and when both fungi are present there is a slight, reddish discoloration towards the inner part of the albedo. At extremes of temperature combined inoculation caused more rapid rotting than either species separately. It appears that these two fungi are responsible for some 95 per cent. of the decay of Italian lemons on the London market, *P. digitatum* alone causing about 72 per cent.

*Oospora citri-aurantii* [ibid., ix, pp. 106, 450, 532, 628] was found on lemons arriving in London from Catania and on fallen fruits in Sicilian orchards. Inoculations of lemons in different stages of maturity showed that very ripe ones were those most rapidly attacked; green ones remained unaffected. Laboratory tests also showed that *O. citri-aurantii* passed more rapidly from diseased to healthy citrus fruits than any other parasite of citrus. When healthy lemons were placed in a damp chamber in contact with inoculated ones in an advanced stage of infection, penetration of sufficiently ripe fruit took place in three days at 20° to 21° and in four days at 15° to 16°; yellowish-green fruits often remained unaffected, infection, when it did develop, taking 14 to 15 days.

Penetration of healthy fruits by contact with diseased ones took place with *P. italicum* in 6 to 8 days at 18° to 21°, with *Phyto-*

*phthora citrophthora* in 5 to 6 days at 20° to 21°, while at the latter temperature *S. sclerotiorum* required 12 days, and *S. minor* and *Botrytis cinerea* 10 days each.

The paper concludes with recommendations for control through improved methods of picking, packing, and local transport.

RABINOVITZ-SERENI (D.). **Sopra una malattia batterica dei Limoni.** [On a bacterial disease of Lemons.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 3, pp. 278–284, 1932.

In 1932 the author received from Sicily a few lemons showing near the distal end round depressions with a thin, raised edge, measuring 10 to 14 mm. in diameter, and at first light yellow, later darkening at the centre. The underlying tissues were dry and the disintegrated cells contained numerous bacteria. The external characters of the condition agreed with the description of those produced by *Bacillus citrimaculans* in South Africa [*R.A.M.*, v, p. 487].

In culture in various media the organism formed yellowish colonies; it was Gram-positive and though usually monotrichous occasionally had three or four lateral flagella. It is regarded as being very probably identical with *B. citrimaculans*. Inoculations of healthy lemon fruits with pure cultures of the organism gave positive results. The condition, which was also observed at Amalfi, is uncommon and unimportant, as it is confined to the fruit.

SAVASTANO (G.). **Una gommosi del Limone causata da 'Dothiorella'.** [A gummosis of Lemon caused by *Dothiorella*.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 3, pp. 245–274, 6 pl., 1932.

Early in 1928 Sicilian lemons, on arrival at Covent Garden market in London, were affected by a dark violet rot resembling that due to *Diplodia* [*natalensis*], but caused by *Dothiorella ribis* [*Botryosphaeria ribis*], which was also subsequently isolated from the trunks of lemon trees affected with a dark amber-coloured gummosis in numerous localities in Sicily. Recorded also in Palestine and near Tunis, the fungus is probably to be found throughout the Mediterranean lemon-growing areas, though this is the first record of it there on the trunks of lemons [cf. *R.A.M.*, xi, pp. 172, 696]. Fawcett considers that the disease is more virulent in Sicily (where it is the most prevalent cause of trunk gummosis) than in California. Attack is favoured by bark injuries caused by wind, hail, or human agency.

In nature the pycnidia were depressed-globular and had papillate ostioles; in culture they generally measured 200 to 325 $\mu$ in diameter. The fusoidal, continuous, hyaline spores in culture measured 10 to 20 by 4 to 5·2 (average 15 by 5 $\mu$). Old cultures gave a few septate spores, a character not reported by other workers. In nature the spores measured 14·4 to 16·8 by 5 to 7·4 $\mu$ (average 16 by 6 $\mu$).

In natural infections the spread was slow at first, but in the second year the necrosed area measured 10 to 18·2 by 9 to 15·5 cm. Attack occurs nearly always above the graft.

Inoculations of the trunks of bitter oranges [*Citrus aurantium* var. *bigaradia*] gave positive results, and caused a brown exudate,

the woody tissues turning a light olive-brown or bluish-lavender. Inoculations of the trunks of two lemon trees gave affected areas measuring in the same period roughly three times as much as in the bitter orange, the diseased wood being dark violet and with a very characteristic odour. The effect of the inoculations was altogether more marked on lemon than on bitter orange. Inoculations of lemon branches also gave positive results, but showed more cicatrization tissue after two years than was present on the trunks. Inoculations of young lemon trees wounded in such a way as to simulate wind injury (by pulling and shaking the boughs) gave lesions, of a type closely similar to those found in nature, near the fork.

Evidence was obtained that before it can become truly pathogenic the fungus requires the presence of adult, mature bark. The inoculation results confirmed the observations on natural infections that the true pathogenic action of the fungus in the trunk and main branches is confined as a rule to the part between the graft and the fork.

Unwounded lemon fruits exposed to infection or tied to inoculated, rotting lemons and kept in a damp chamber at 23° C. for one month remained unaffected. When mycelium or pieces of diseased fruits were carefully kept in contact with the unwounded bark of lemon trees (the inoculum being renewed) no penetration took place in nine months. The organism is therefore definitely regarded as purely a wound parasite. The most consistently positive results on the fruit were given by removing the stalks and inserting pieces of mycelium between the fibrovascular bundles. Inoculations of lemon fruits with the organism obtained from trunk lesions gave positive results and *vice versa*.

The optimum growth temperature for the fungus was ascertained to be about 28°, the maximum about 32°, and the minimum under 10°. At temperatures up to 18° the mycelium remained whitish for the first three days, whereas at 20° or over it showed a characteristic dark colour. The organism lived *in vitro* for 22 months at $-1°$ to $+1°$, for 15 months at laboratory temperature (15° to 26°), and for about 10 months at 20° to 21°.

Reichert (I.) & Hellinger (E[sther].). **Blemishes and their influence on the keeping quality of Oranges.**—*Hadar*, v, 12, pp. 287–292, 6 figs., 5 graphs, 1932.

Popular notes, based on observations made in three groves in 1930–1, are given on some types of blemishes affecting Palestine oranges and impairing to a varying extent the value and keeping quality of the fruit [cf. *R.A.M.*, xi, p. 780]. Silver scurf, which occurred on about 30 per cent. of the fruits, is due to a liberation of oil caused by the wind or insects chafing the cells and producing silvery, greyish, or brownish, irregular, scaly areas on the fruit. 'Faroosh' is characterized by a puffing and grooving of the rind [ibid., viii, p. 450], which tends to loosen from the pulp and is soft to the touch. This condition is usually attributed to irregularities of growth in the rind due to intermittent spells of drought and moisture, the former checking and the latter accelerating development. Sooty mould (*Fumago*) occurred on

9·9 per cent. of the fruit in the three groves. 'Nooksan' or 'missing flesh' is the name given to the shallow, sunken pox spots of variable dimensions on growing or stored fruit. This collapse of the cells between the oil glands, frequently observed in November, may be due to the action of hot, dry winds on the unripe fruits.

The total amount of entirely unblemished fruit in Palestine during the 1930–1 season was estimated at not over 30 per cent. Neither silver scurf nor sooty mould was responsible for any appreciable increase in the wastage of stored fruit. The average incidence of rind puffing was only 3·7 per cent., but the storage losses from this source were considerable (up to 20·7 per cent.). The 'missing flesh' disorder occurred on 2·4 per cent. of the fruit and caused a variable amount of wastage (0 to 5·2 per cent.).

MAYNE (W. W.). **Annual Report of the Coffee Scientific Officer, 1931–1932.**—*Mysore Coffee Exper. Stat. Bull.* 7, 32 pp., 1932.

Laboratory investigations conducted in Mysore during the period under review showed that the spores of *Hemileia vastatrix* did not germinate in the absence of liquid water, but that complete submersion exercised a depressing effect on the development of the germ-tubes. It was also ascertained that light had an inhibitory action on germination [*R.A.M.*, xi, pp. 563, 637]. Field observations showed that the severity of the annual attacks of coffee leaf disease is largely determined by the amount of heavy mist and dew occurring during the rainless months. Two collections of the spores of *H. vastatrix* kept in sealed tubes at laboratory temperature and medium humidity failed to germinate after six months. Inoculations of detached Coorg coffee leaves with spores taken from leaves of the same variety indicated that 7 to 12 days elapse between infection and the first appearance of a yellow spot, and 15 to 24 days between infection and the first appearance of spores. When susceptible Robusta leaves were inoculated much longer periods (20 and 29 to 35 days, respectively) were required for the development of visible spots and of spores.

Spore trap observations towards the end of the south-west monsoon showed that *H. vastatrix* was much more prevalent in areas sheltered from the wind than in exposed areas. The later development of the disease in wind-swept localities is considered to be due to many of the spores being carried beyond the limits of the coffee. The use of wind breaks to act as spore barriers merits consideration.

A type of coffee root disease somewhat resembling red root disease of tea (*Poria hypolateritia*) [ibid., xi, p. 749] was occasionally found in patches. Another of some importance, near Gudalur, yielded a fungus which in growth characters resembled *Fomes applanatus* [*Ganoderma applanatum*]. Most of the trees affected with this disease showed few above-ground symptoms, but the tap-root wood was discoloured and emitted a mushroom-like odour; in advanced stages the wood was spongy and wet. The disease apparently progressed slowly, and almost invariably a dead stump was present near the affected tree; in one instance,

the spread of the disease along a large root of a dead stump to the dying coffee tree was definitely established.

In further tests of the relative effects of different spray mixtures [used chiefly against *H. vastatrix*: cf. ibid., xi, p. 41] on the coffee plant, the following figures were obtained for the number of leaves per growing shoot of each branch system treated: linseed Bordeaux mixture (10 oz. linseed) $6{\cdot}28 \pm 0{\cdot}23$; casein Bordeaux mixture $6{\cdot}19 \pm 0{\cdot}24$; fish oil-resin soap-Burgundy mixture $5{\cdot}66 \pm 0{\cdot}26$; resin soda-Bordeaux mixture $5{\cdot}95 \pm 0{\cdot}20$; alum Bordeaux mixture $6{\cdot}00 \pm 0{\cdot}28$; resin soda-Burgundy mixture $5{\cdot}97 \pm 0{\cdot}21$; 3 per cent. solbar $5{\cdot}12 \pm 0{\cdot}19$. The figures for the unsprayed control and for Bordeaux mixture without adhesives were, respectively, $3{\cdot}13 \pm 0{\cdot}17$ and $5{\cdot}40 \pm 0{\cdot}19$. The statistically significant differences between the figures obtained with and without casein suggest that adhesives are definitely advantageous, but in view of the relatively high figure obtained even without an adhesive and of the fact that the 1931 monsoon was very heavy, it is thought probable that the omission of an adhesive in the September-October spraying would not seriously affect the degree of protection afforded. Further evidence was obtained that the pre-monsoon application is more effective against *H. vastatrix* than the post-monsoon spraying.

GANDRUP (J.). **Phytopathologische problemen in de Koffiecultuur.** [Phytopathological problems in Coffee cultivation.] —*De Bergcultures*, vi, 51, pp. 1388–1397, 1932.

In the course of a lecture on phytopathological problems in coffee cultivation delivered at a recent meeting of the Planters' Union of Semarang-Kedoe, allusion was briefly made to two diseases of outstanding importance in Java, namely, brown root rot [*Fomes noxius*: *R.A.M.*, xii, p. 55] and top die-back associated with a species of *Rhizoctonia* [ibid., ix, p. 305; xi, p. 636, *et passim*]. A report of the ensuing discussion is given.

FIKRY (A.). **Investigations on the wilt disease of Egyptian Cotton caused by various species of Fusarium.**—*Min. of Agric., Egypt, Tech. and Sci. Service (Plant Protect. Sect.) Bull.* 119, 106 pp., 16 pl., 7 graphs, 1932.

This is a considerably amplified version of the author's account of his work in connexion with the wilt disease (*Fusarium orthoceras*, *F. vasinfectum* var. *inodorum*, and *F. angustum*) of cotton in Egypt [*R.A.M.*, xi, p. 513], giving a detailed description of the technique used in most of the experiments. Among other items of interest the paper includes a detailed study of the cultural characters of the pathogenic fungi on a number of media, and of the influence of certain environmental factors on the infective capacity of *F. orthoceras* and on the growth of cotton seedlings, the results of which are considered to explain the fact that the disease is most destructive in the summer months, when irrigation is at its highest. In all three species the colour of the mycelium was pure white in the dark, and pale pinkish in the light, and spores were formed more abundantly in the absence of light; there was some evidence also that more plants became wilted when kept

in the dark than when left exposed to light. None of the pathogenic or non-pathogenic forms isolated from wilted plants could grow in the absence of air, but they were still alive at the end of 12 days. Chlamydospores only were present in culture tubes kept sealed for two years, and these germinated readily when transferred to a fresh medium. Although the cotton plants did not show appreciable resistance to wilt when the carbon dioxide concentration in the atmosphere was increased to 30 parts in 10,000, they grew stronger and better at the high concentrations than in normal air.

Considerable details are also given of experiments to establish the effect of certain fungicides on the fungi and on cotton seedlings, when applied to the soil and to culture media. In the latter the growth of the fungi was inhibited by the presence of 0·1 per cent. of formalin, 0·7 per cent. of copper sulphate, or 0·01 per cent. mercuric chloride; cut plants wilted in all the fungicidal solutions tested, except in 0·003 per cent. mercuric chloride. Under glass-house conditions in experiments carried out in England the wilt fungi could be controlled without injury to the plants by applications to the soil of 0·4 per cent. formalin or 0·5 per cent. copper sulphate (calculated to the total weight of the soil). When Egyptian heavy clay soils were used, similar results were given by 0·4 per cent. or 1·25 per cent. of these substances, respectively, these doses having no injurious effect on the cotton. Mercuric chloride had a depressing effect on the germination of the seed and on plant growth, and is not recommended.

King (C. G.) & Hope (C.). **Distribution of the Cotton foot-rot fungus in soil and in plant tissues in relation to control by disinfectants.**—*Journ. Agric. Res.*, xlv, 12, pp. 725–740, 7 figs., 2 diags., 1932.

This is a detailed account of incidental observations that were made during an attempt in 1930 to eradicate the cotton root rot fungus (*Phymatotrichum omnivorum*) [*R.A.M.*, xii, p. 216] from an isolated area near Indio, California, by means of a 1·25 per cent. formalin solution introduced under pressure to a depth of 6 ft. in the soil [ibid., xi, p. 713]. Methods are also briefly described, which were evolved during the work and served for the detection of the fungus even where no indicator plants were present. It was found that the organism is able to exist in an active condition for a long period on the roots of removed trees, and that the mycelium inside such roots resisted the action of the disinfectant for a longer period than that outside; the latter was always found to be dead about 10 months after the treatment, at which time all the sclerotia of the fungus that were examined were also dead, while sclerotia from a culture kept in the laboratory remained viable at the end of two and a half years. Laboratory tests showed that all the parts of a sclerotium are capable of giving a mycelial growth.

Further observations both in that area and elsewhere indicated that the distribution of the sclerotia in infected soil is very uneven, both vertically and horizontally. In one locality a few were found at a depth of 84 to 90 inches.

ZEISLER (E. P.). **Chronic coccidioidal dermatitis. Report of an unusual case.**—*Arch. of Dermatol.*, xxv, 1, pp. 52–71, 16 figs., 1932.

A full account is given of an unusual case of extensive chronic dermatitis due to *Coccidioides immitis* [*R.A.M.*, xii, p. 217], which is believed to have entered through the skin and to have been contracted from a dog. The histologic changes produced by the growth of the fungus in the tissues in the form of nodules surrounding the blood vessels suggest dissemination by the blood stream. In one section of a growing nodule a peculiar type of endosporulation was observed, the cyst being about twice the usual size and containing few spores, with a clear, hyaline, central, spherical spore taking the nuclear stain and a segmental peripheral distribution of the remaining spores in a radial fashion. This form is stated to have been seen only once previously, by Rixford and Gilchrist. Ordinarily the cysts contain numerous small, evenly distributed spores.

GOUGEROT [H.] & DUCHÉ [J.]. **Endomycose ulcéreuse végétante du nez due à Endomyces albicans.** [A spreading ulcerous endomycosis of the nose due to *Endomyces albicans*.]—*Bull. Soc. Franç. de Dermatol.*, *1932*, 9, p. 1624, 1932.

*Endomyces albicans* [*R.A.M.*, vi, p. 484] was isolated from a spreading ulcer on the nostril of a female patient.

CATANEI (A.). **Die Blastomykosen in Nordafrika.** [The blastomycoses in North Africa.]—*7ª Reunion Soc. Argentina Patol. Region Norte*, i, pp. 222–226, Buenos Aires, Imprenta Univ., 1932. [Abs. in *Zentralbl. für Bakt.*, Ab. 1 (*Ref.*), cix, 7–8, p. 160, 1933.]

Since 1911 five cases of human blastomycosis have been recorded in Tunis, Morocco, and Algeria, caused by *Mycoderma brocianum*, *Monilia castellanii* [*R.A.M.*, v, p. 98], and *Enantiothamnus braulti*. A description is given of a sixth case in an Algerian woman with an ulcerous affection of the arm, from which *Cryptococcus montpellieri* Catanei 1926 [previously cited in error as *C. catanei*: ibid., vi, p. 32] was isolated and inoculated into rabbits and guinea-pigs with positive results.

MAZZA (S.) & PALAMEDI (B.). **Ein Fall tödlich verlaufener Blastomykose an Haut und Schleimhaut.** [A case of blastomycosis of the skin and mucous membrane with a fatal outcome.]—*7ª Reunion Soc. Argentina Patol. Region Norte*, i, pp. 424–467, 1 pl., 50 figs., Buenos Aires, Imprenta Univ., 1932. [Abs. in *Zentralbl. für Bakt.*, Ab. 1 (*Ref.*), cix, 7–8, pp. 159–160, 1933.]

The development of an abscess on the toe of a labourer was followed three months later by ulcers of the oral membrane, tongue, and gums, with ultimate extension to the throat, respiratory tubes, and lungs, resulting in death. The causal organism was identified as an undescribed species of *Monilia* which is named

*M. inexorabilis.* A full account is given of the morphology and physiology of the fungus and its pathogenicity to animals, together with clinical details of the case.

PEUTZ (J. L. A.). **Primaire aspergillose der longen.** [Primary aspergillosis of the lungs.]—*Nederl. Tijdschr. voor Geneeskunde*, lxxvi (i), 5, pp. 446–451, 1 pl., 1932. [French, English, and German summaries.]

A young man employed in a carpet and tapestry business in Holland suffered from a chronic illness resembling pulmonary tuberculosis. *Aspergillus fumigatus* was isolated from an abscess in one of the lungs and is considered to be the direct cause of the disease [cf. *R.A.M.*, x, p. 28].

MERIIN (J. A.). **Weitere Beobachtungen über den Erreger der europäischen Chromoblastomycosis.** [Further observations on the agent of European chromoblastomycosis.]—*Arch. für Dermatol.*, clxvi, 3, pp. 722–729, 6 figs., 1932.

Two further cases of chromoblastomycosis due to *Hormodendrum rossicum* [*R.A.M.*, x, p. 314] in Russia are described. The new strains differ from that previously reported ('W') primarily in the smaller size of the spherical bodies (6 to 12 $\mu$ as compared with 11 to 36 $\mu$) in the pus. In one strain ('R') nodular forms were observed which appear to denote a variant. From this strain a filtrate was obtained that gave a specific reaction on intradermal injection. Strain 'R' was pathogenic to rats and mice but not to guinea-pigs.

LEHNER (E.). **Über einen Fall von Acremoniosis.** [On a case of acremoniosis.]—*Arch. für Dermatol.*, clxvi, 2, pp. 399–404, 1932.

Details are given of a Hungarian case of acremoniosis, the primary manifestation of which was a centrifugally progressive, chronic erythemato-vesicular affection of the hands, whence the causal organism passed into the blood stream and ultimately caused the development of lesions resembling erythema multiforme and erythema annulare on the body and extremities. A vaccine prepared from the fungus (a species of *Acremonium*) [*R.A.M.*, xii, p. 219 and next abstract] induced a strongly positive reaction in the patient at a dilution of 1 in 500, accompanied by excessive susceptibility to contact with certain plant (e.g., geranium) leaves. Since acremoniosis is an extremely rare disease, the fungus normally being scarcely pathogenic, it is thought that the susceptibility to the plant antigen developed first and combined with the fungus antigen to produce the above-mentioned effects.

BALLAGI (S.). **Mykologische Beschreibung der Acremoniosis.** [Mycological description of acremoniosis.]—*Arch. für Dermatol.*, clxvi, 2, pp. 405–407, 2 figs., 1932.

Lehner's *Acremonium* [see preceding abstract] was cultured on Sabouraud's medium, on which it formed white, later yellow, and eventually hazel-nut-coloured colonies, echinulate in the centre with peripheral convolutions. The mycelium is hyaline, glistening,

with a tendency to coremial formation, and consists of septate hyphae, 3 to 4 $\mu$ in diameter. The conidiophores range from 15 to 30 $\mu$ in length and 3 to 4 $\mu$ or more in breadth and bear at their apices hyaline, glistening conidial heads, measuring 16 to 25 $\mu$ and consisting of numerous oval conidia, 2 to 3 $\mu$ in diameter, developed singly at the extremity of the conidiophore. The optimum temperature for the development of the fungus is 18° to 20° C.; no growth was made at 37°. The organism proved to be practically innocuous to guinea-pigs. In glucose and peptone cultures the colonies developed a pinkish coloration and a 'down' resembling the pleomorphic 'duvet' of the dermatophytes [cf. *R.A.M.*, xi, p. 373].

MILLER (H. E.) & MORROW (H.). **Cephalosporiosis: an unusual mycotic infection.**—*Arch. of Dermatol.*, xxv, 2, pp. 294–303, 10 figs., 1932.

A species of *Cephalosporium* (*Acremonium*) [see preceding abstracts] was isolated from a gumma-like lesion of the soft palate and tonsillar region of a young man in California, this being apparently the first record of such a condition in the United States. Attention is drawn to five other cases recently reported in foreign literature. The fungus was characterized by a very delicate mycelium with ellipsoidal conidia at the ends of fairly long, thread-like conidiophores. In six- to twelve-week-old cultures there was a central blackish-grey, powdery elevation composed of conidia. No gas was produced in any sugar media, but gelatine was liquefied in three to four weeks. The optimum temperature for growth was 18° to 20° C., failure commencing at 37° and death occurring in 24 hours at 40°. The fungus was non-pathogenic to laboratory animals.

KAMBAYASHI (T.). **Botanische Untersuchungen über japanische Fadenpilze, die auf der Menschenhaut parasitieren.** [Botanical studies on Japanese Hyphomycetes that parasitize the human skin.]—*Bot. Mag.*, Tokyo, xlvi, 552, pp. 751–771, 3 pl., 25 figs., 1932.

*Microsporon japonicum*, the agent of a human ringworm in Japan [*R.A.M.*, ix, p. 525], is characterized by hyaline, straight or slightly undulating, sparsely branched, septate hyphae, 2 to 3·5 $\mu$ in width; rudimentary conidiophores bearing sessile, spherical, oval to piriform conidia, 4 to 5 by 2 to 3·5 $\mu$; 'racquet'-like hyphae, 2 to 4·5 $\mu$ in width, and (in older cultures) completely atypical lateral branches developed near the septa and forming a profusion of short, fasciculate, irregularly elongated-cylindrical, elliptical, or polyhedric elements. Spherical to oval or irregularly shaped chlamydospores, 12 to 19 by 4 to 9 $\mu$, with occasional spindle spores, are also developed, and twice (in old cultures, 261 days and about two years, respectively), ascus-like bodies containing a variable number (4 to 12) of cell inclusions, presumably ascospores, were observed.

The cultural characters of *M. japonicum* are stated to be quite distinct from those of the 27 species of *Microsporon* described by Bruhns and Alexander (Handbuch der Haut- und Geschlechts-

krankheiten von Jadassohn, xi, pp. 54-61, 121–145, 1928). The centre of the colony on glucose or maltose agar is brownish-yellow to chocolate-brown, with brownish-yellow to reddish peripheral radiations.

SMYTH (H. F.) & SMYTH (H. F.). **Action of pine oil on some fungi of the skin, in vitro.**—*Arch. of Dermatol.*, xxvi, 6, pp. 1079–1085, 1 diag., 1 graph, 1932.

The results of tests to ascertain the action of pine oil and certain of its purified components on cultures of various ringworm fungi are reported. The various organisms showed fairly clear-cut differences in resistance to the oils, proportionate in some degree to the severity of the infections they cause. One strain of *Trichophyton granulosum* [*R.A.M.*, x, p. 458], responsible for the most severe infections of this group, was killed in one hour by fenchyl alcohol and in 30 minutes by 'very pale yellow' pine oil, while another succumbed only to alpha-terpineol in 30 minutes. The oils were only effective at a strength of 100 per cent. *T. interdigitale* [*T. mentagrophytes*: ibid., x, p. 243], to which Weidman (*Arch. of Dermatol.*, xv, p. 415, 1927) attributes well over half the cases of ringworm in the United States, was killed in four of the five strains tested within five minutes by the 'very pale yellow' oil, while the fifth strain was only slightly affected after 30 minutes. Two strains of *T. purpureum* were killed in 10 to 15 minutes and *E. inguinale* [*E. floccosum*] and *Microsporon fulvum* [ibid., vii, p. 634] in five minutes by the 'very pale yellow' oil, while *Sporotrichum schenckii* [ibid., xi, p. 646] was not killed after five hours by this substance, but succumbed to alpha-terpineol, fenchyl alcohol, and white pine oil in 1½, 1, and 5 hours, respectively.

JENKINS (ANNA E.) & WHITE (R. P.). **Identification of Diaporthe umbrina on Rose from England.**—*Mycologia*, xxiv, 6, pp. 485–488, 2 pl., 1932.

Examination of material of brown canker of the rose sent from England is stated to have established that the causal fungus, apart from slight cultural differences, is identical with *Diaporthe umbrina* previously reported from the United States alone [*R.A.M.*, x, p. 666; xii, p. 25].

TAUBENHAUS (J. J.) & EZEKIEL (W. N.). **Sclerotinia wilt of greenhouse Snapdragons.**—*Amer. Journ. of Botany*, xix, 10, pp. 808–811, 1 fig., 1932.

Autumn greenhouse snapdragons [*Antirrhinum majus*] near Temple, Texas, were attacked in 1927 by a serious wilt disease causing the death of 60 per cent. of the plants with a financial loss of $20,000. The shrunken stems were covered with a copious white weft of mycelium with numerous large sclerotia, of which 466 were collected in an area of 64 sq. ft., 171 being formed on the surface of the diseased stems, 92 inside them, and 203 on the ground. The fungus apparently spreads by direct contact of the collapsed, infected plants with neighbouring healthy ones, as well as along the surface of the soil. It was isolated from diseased

material and identified as *Sclerotinia sclerotiorum* [*R.A.M.*, vi, p. 554]. Inoculation tests on snapdragons with the fungus from the same host, as well as from celery and beans, and with apothecia from under diseased fig trees [ibid., xi, p. 313], gave positive results, and the sclerotia thus produced yielded the typical apothecia, asci, and ascospores of *S. sclerotiorum*.

LEMESLE (R.). **Nouvelles recherches sur le Scabiosa succisa L. attaqué par le Fusarium anthophilum (A.Br.) Wr.** [Further studies on *Scabiosa succisa* L. attacked by *Fusarium anthophilum* (A.Br.) Wr.]—*Comptes rendus Acad. des Sciences*, cxcv, 25, pp. 1319–1321, 1 fig., 1932.

Further studies on the mechanism of infection of *Scabiosa succisa* by *Fusarium anthophilum* [*R.A.M.*, ix, p. 654] revealed the presence of abundant mycelium within the ovule, the hyphae penetrating by way of the micropyle. So densely are the hyphae aggregated that neither the embryonal sac nor the elements forming the inner coating of the tegument can be discerned. The lower part of the ovule is often covered with mycelium which extends down the longitudinal axis of the carpel to the base of the ovarial cavity. The infected ovules are usually abnormally small, but in no case has complete atrophy been observed, and as a rule the flowers retain their natural blue colour. In a few instances of discoloration of the corollas the fungus was found on the anthers, style, and stigmas.

McWHORTER (F. P.). **A preliminary analysis of Tulip breaking.**—Abs. in *Phytopath.*, xxii, 12, p. 998, 1932.

The common variegated flower colour of tulips known as 'breaking' or 'mosaic' [*R.A.M.*, xi, p. 718] is believed to result from the action or interaction of two viruses, one of which carries a colour-adding factor and produces no visible effect on the leaves, while the other removes the flower colour and causes marked striping of the foliage. Certain varieties, when 'broken', tend to segregate into plants or parts of plants (clumps) bearing strongly darkened or markedly bleached flowers. By means of selection and the use of inoculum prepared from the parts of flowers where the colour was removed and darkened, respectively, the viruses have been secured in an almost pure state. The colour-adding virus has little effect on plant growth and may be of practical value in the development of 'new' varieties. The colour-removing principle, on the other hand, is extremely virulent, reducing plant growth to one-third of the normal. Cross-inoculations with the juice from leaves of mosaic [*Lilium*] *speciosum* plants indicate that these contain a virus indistinguishable from that of the bleaching virus of tulips.

WHETZEL (H. H.) & DRAYTON (F. L.). **A new species of Botrytis on rhizomatous Iris.**—*Mycologia*, xxiv, 6, pp. 469–476, 2 pl., 1 fig., 1932.

A morphological and cultural account is given of a hitherto undescribed species of *Botrytis*, which is named *B. convoluta* n.sp., and which since 1924 has been observed causing a serious rot of

the rhizomes of species of *Iris* at Ithaca, N.Y., Washington, D.C., and near Ottawa, Canada. The same fungus is stated to have been intercepted during the past ten years on several occasions by the United States Customs on iris rhizomes imported from France, Germany, England, and Holland.

In the field affected plants either fail to develop new leaves in the spring, or a few shoots may develop which later turn yellow and die by midsummer; the plants are easily pulled out of the ground, owing to the decayed condition of the root system. The rhizomes are shrivelled and partially or completely rotted; the diseased flesh is grey-brown, dry and pithy, with distinct rifts in the decaying tissues, but with no disagreeable smell. On the surface of the rhizomes or breaking through the epidermis are agglomerations of characteristically convolute, shiny black sclerotia. The pathogenicity of the fungus was proved by successful inoculations of healthy rhizomes in the laboratory. There was evidence that it gains entrance to the host tissues in nature through wounds, and that its pathogenic activity occurs only during the colder part of the year.

*B. convoluta* [a Latin diagnosis of which is given] is characterized by a branching, septate, hyaline (later tan-coloured) mycelium, forming shiny black, convolute, agglomerated sclerotia up to 18 by 16 mm. in diameter. The conidiophores, arising on the mycelium and sclerotia, are brown, erect, fasciculate, branched at the apex, and about 1 mm. high. The conidia are light brown, continuous, smooth, ovate to slightly piriform, borne in dense clusters, and varying in size from 7 to 19 by 5·25 to 12·75 $\mu$ (mode 11 to 11·75 by 9 to 9·75 $\mu$, and average 11·41 by 9·25 $\mu$ in nature, but somewhat smaller when produced in culture). The appressoria are of the *B. cinerea* type. Microconidia have been observed in pure cultures of the fungus. They are globose, hyaline, 2·5 to 4·5 $\mu$ in diameter, and produced on typical fasciculate conidiophores.

NANNIZZI (A.). **Nuove specie di micromiceti parassiti o saprofiti su piante coltivate.** [New species of micromycetes parasitic or saprophytic on cultivated plants.]—*Arch. Bot.*, viii, pp. 296–301, 1932. [Abs. in *Riv. Pat. Veg.*, xxii, 9–10, pp. 326–327, 1932.]

Notes are given on the following new species found in the Botanical Gardens, Siena: *Phyllostictella draconis* on living leaves of *Dracaena draco, Septoria iridis-japonicae* on living leaves of *Iris japonica*, on which it caused severe injury, and *Coryneum feijoae* on living leaves of *Feijoa sellowiana,* together with several saprophytic species found on various plants.

HAMMARLUND (C.). **Zur Biologie des Mahonia-Rostes (Puccinia mirabilissima Peck). (Vorläufige Mitteilung).** [On the biology of the *Mahonia* rust (*Puccinia mirabilissima* Peck). (Preliminary note).]—*Bot. Notiser, 1932,* 6, pp. 401–416, 2 figs., 1 map, 1932.

Details are given of the writer's inoculation experiments with *Puccinia mirabilissima* on *Mahonia* [*Berberis*] *aquifolium* leaves

[*R.A.M.*, xi, p. 580]. The tests were conducted with aecidiospores, basidiospores, and uredospores on both young and old leaves. The inoculations with basidiospores were successful only on young foliage, whereas those with aecidio- and uredospores gave positive results mainly on older leaves. These results are in agreement with the observations made in nature, aecidia never being found on older leaves while uredosori are seldom detected on young foliage. The genetic connexion between the aecidial and teleutospore stages of the rust was clearly established by the author's inoculations, and notes are given on the distinguishing characters of the aecidia of *P. mirabilissima* and those of *P. graminis*, which were also found to be not uncommon on *B. aquifolium* in Sweden [see below, p. 330].

Teleutospores occur most frequently in the north of the country, where the climatic conditions are extremely severe, and are relatively seldom formed in the milder southern and western regions.

BLATTNÝ (C.) & VUKOLOV (V.). **Mosaik bei Epiphyllum truncatum.** [Mosaic of *Epiphyllum truncatum*.]—*Gartenbauwissensch.*, vi, p. 425, 2 figs., 1932. [Abs. in *Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz*, xliii, 2, pp. 88–89, 1933.]

A virus disease, characterized by scanty, retarded flowering and shedding of buds, and in severe cases by premature death, was observed in 1929 on the cactus *Epiphyllum truncatum* grafted on *Peireskia aculeata* [? in Czecho-Slovakia]. The disturbance, which is macroscopically distinct from the allied conditions of albicatio and chlorosis [*R.A.M.*, xi, p. 387], was experimentally shown to be transmissible by *Orthezia insignis* and by the sap of affected plants; the typical symptoms could further be induced in *E. truncatum* scions by injecting the diseased sap into the tissues of the *Peireskia* stocks. The disease appears to be favoured by dryness of the soil and atmosphere as well as by high temperatures.

DORPH-PETERSEN (K.). **Beretning fra Statsfrøkontrollen for det 61. Arbejdsaar fra 1 Juli 1931 til 30 Juni 1932.** [Report of the State Seed Testing Service for the 61st year of activity from 1st July, 1931 to 30th June, 1932.]—*Tidsskr. for Planteavl*, xxxviii, 5, pp. 713–792, 1932.

Section viii of this report (pp. 757–759) contains some items of phytopathological interest [cf. *R.A.M.*, xi, p. 304]. Figures are given of the numbers of samples of various grass seeds in which sclerotia of *Claviceps purpurea* were found. Sclerotia of the closely related *C. microcephala* were found in 7 out of 50 samples of rough-stalked meadow grass [*Poa trivialis*] and in 29 out of 61 of meadow grass [*P. pratensis*]. They are, moreover, practically ubiquitous in creeping bent grass [*Agrostis stolonifera*] samples.

Similar data are given for the occurrence of *Sclerotium trifoliorum* and *Typhula trifolii* in clover seed, *Ustilago perennans* in that of *Avena elatior*, *U. bromivora* in *Bromus arvensis*, *Tilletia holci* in *Holcus lanatus*, and *Erwinia* [*Phytomonas*] *rathayi* in *Dactylis glomerata* seed.

SCHLIESING. **Erfolgreiche gemeindeweise Schädlingsbekämpfung im Obstbau.** [Successful community spraying against orchard pests.]—*Nachricht. über Schädlingsbekämpf.*, vii, 4, pp. 131–133, 1932.

Highly satisfactory results are stated to have been obtained in the Osnabrück [Westphalia] district by community spraying against fruit diseases and pests with solbar and nosprasit 'O' [*R.A.M.*, xii, p. 33] in 1 per cent. solutions, using 3 to 8 l. per tree.

WALLACE (T.). **The effect of orchard factors on the storage quality of fruits.**—*H*[*ortic.*] *E*[*ducational*] *A*[*ssoc.*] *Year Book*, i, pp. 71–75, 1932.

Five years' investigations at Long Ashton, Bristol, have shown that the storage quality of fruit is strongly affected by factors operating in the orchard. These are (a) material factors, comprising class of fruit, variety, rootstock, and age of tree; and (b) environmental and management factors, the former including climate, weather, soil, and parasites, and the latter soil treatments, cultural and manual operations, parasite control, time of picking, size grading, handling, and crop weight. From a knowledge of all these, a fairly accurate idea of the storage quality of a consignment may be obtained; some, such as drastic deficiencies of nitrogen or potassium, produce dominant influences which determine the main storage characters of a consignment. The effect of the individual factors on breakdown and in one or two instances on rots is briefly discussed.

HUBER (G. A.) & HEALD (F. D.). **The sources of contamination of the normal Apple and spore load.**—Abs. in *Phytopath.*, xxii, 12, p. 1001, 1932.

Fungous infection of apples is initiated in the orchard [*R.A.M.*, xii, p. 32], where analyses of the air at harvest time disclosed the presence of 25 to 500 spores per cu. ft. Apples carefully picked off the trees and so handled as to prevent further contamination bore from 14,000 to 159,100 spores each. Fruits from surface-irrigated plots each bore on an average 36,766 spores, the corresponding number for those from overhead-irrigated plots being 119,616. Dirty picking-boxes showed an average load of 108,050,160 fungus spores on the interior surface. A box with the maximum contamination carried a load of 109,958,400 spores on the inner surface of the bottom boards only, of which 32,987,520 were *Penicillium* types, mostly *P. expansum* [ibid., xii, p. 226]. The air in packing houses during the packing season yielded 32 to 994 spores per cu. ft., a reduction in the number being observed where sanitary measures were practised. The palms of gloves worn by sorters bore 12,100 to 40,000 spores per sq. in.

HOWITT (J. E.). **Apple orchard spray service in Ontario.**—*Scient. Agric.*, xiii, 4, pp. 256–259, 1932.

In giving some details of the organization of the apple orchard spray service in the province of Ontario, the author states that, owing to the conspicuously satisfactory results obtained since the first year of its inception in 1924, the service has gradually

extended until now it includes almost every apple-growing district in the province; from four orchards with which it began, the number under supervision rose to 1,374 in 1932, requiring the co-operation of fifteen local supervisors working under the direction of the heads of the service at the Ontario Agricultural College, Guelph.

GODBOUT (F. L.) & COULSON (J. G.). **Quebec orchard spray service.**—*Scient. Agric.*, xiii, 4, pp. 249–255, 1 map, 1932.

The authors give a brief description of the organization and working of the orchard spray service which was inaugurated in the province of Quebec in 1929, and is directed more particularly towards the control of the apple scab fungus [*Venturia inaequalis*]. Some details are also given of the results obtained in the study of the epidemiology and biology of the organism, most of which have already been noticed from time to time in this *Review*.

PARHAM (B. E.). **Apple and Pear black spot (scab). Comparative records of the ascospore discharge in Venturia inaequalis (Cke) Aderhold and V. pirina Aderh. throughout New Zealand in the spring of 1931.**—*New Zealand Journ. of Sci. and Techn.*, xiv, 3, pp. 184–192, 1932.

During the spring (August to December) of 1931, the writer obtained comparative records of ascospore discharge in the apple and pear scab fungi (*Venturia inaequalis* and *V. pirina*) from two districts (Auckland and Hawke's Bay) in North Island, and two (Nelson and Otago) in South Island, New Zealand [cf. *R.A.M.*, xii, p. 32]. The spores were trapped in the ordinary way on glass slides with a layer of gelatine in the centre.

The results [which are tabulated] of the investigation showed that in the Auckland district, ascospore discharge in apple leaves began in the week ending 26th August and ceased during the last week of October with the breaking-up of the foliage—otherwise the process would probably have continued since discharge was still active. Two periods of relatively high discharge occurred, viz., in mid-September and the second to the third week in October. The initial discharge of pear scab ascospores did not take place until the beginning of September in Auckland, but the process continued until the beginning of December, maximum activity being recorded at the end of September, second week, middle, and end of October, and first week of November. The discharge period for apple leaves in the Hawke's Bay district lasted from 11th September to 27th November, reaching a climax at the end of September, continuing heavy during the first week of October, and resuming activity in the third week of that month after a temporary decline. The pear leaf discharge in the same district extended only from 6th September to 25th October, with a peak during the latter half of September. At Outram, Otago, the ascospore discharge from both apple and pear leaves began in the last week of September; the foliage disintegrated during the second week of October, when the activity of both fungi was at its height. At Beaumont the discharge began a week earlier than at Outram and continued until the second week in December.

In the Nelson district the spring was unusually dry, and the discharge period consequently protracted. It began in apple leaves on 26th August and lasted until 21st December, the corresponding period for pears being 31st August to 17th December. The peak was not reached in the apple fungus until 3rd November, whereas the maximum discharge from pear foliage occurred during the first week of October.

These data are considered to indicate a fairly high degree of uniformity throughout New Zealand in 1931 in the behaviour of apple and pear scab, both as regards the commencement and duration of ascospore activity, and also the frequency and disposition of the peak periods. A seasonal comparison between records secured at Nelson in 1921 and 1931 further denotes a marked regularity in the behaviour of the fungi from season to season, both in respect of the total period of ascospore discharge and the regular occurrence of the maximum discharges for the season during the last week of September and the first fortnight of October.

LOEWEL (E. L.). **Schwefelkalk-Bleiarseniat oder Kupfermittel zur Bekämpfung des Fusikladiums?** [Lime-sulphur-lead arsenate or copper preparations for *Fusicladium* control?]—*Obst- und Gemüsebau*, lxxviii, 11, pp. 175–176, 1932.

Some further observations are made in connexion with the writer's investigations in the Altenland district [Schleswig-Holstein] on the relative merits of lime-sulphur with lead arsenate and various copper-containing preparations in the control of apple scab (*Fusicladium*) [*Venturia inaequalis*: *R.A.M.*, xii, p. 31]. The following schedule may be recommended as suitable for most of the local varieties (except Lord Grosvenor, to which lime-sulphur must not be applied after flowering on account of leaf russeting): middle of March to beginning of April, 10 per cent. carbolineum; middle of April, 2 per cent. Bordeaux mixture; beginning of May, 1 per cent. nosprasit or 0·4 per cent. Hercynia neutral; after petal fall and again in the middle of June, 2 per cent. lime-sulphur and 1 per cent. lead arsenate paste; and middle of July, 0·3 to 0·5 per cent. nosprasit.

MOORE (M. H.). **Further studies on the incidence and control of Apple scab (Venturia inaequalis) and Apple mildew (Podosphaera leucotricha) at East Malling.**—*Journ. Pomol. and Hort. Science*, x, 4, pp. 271–294, 1932.

The results [which are tabulated and discussed] of continued experiments in 1930 at the East Malling Research Station on the control of apple scab (*Venturia inaequalis*) and apple mildew (*Podosphaera leucotricha*) [*R.A.M.*, x, p. 465] again confirmed the previous finding that on Cox's Orange Pippin lime-sulphur is the most satisfactory spray against both diseases, especially when applied three times, once before and twice after blossoming. When applied post-blossom only, at the strength of 1 in 100, it caused fruit drop, although the trees thus treated did not show any reduction in picked crop below that on comparable Bordeaux-sprayed or control trees. Bordeaux mixture again showed a

tendency to cause spray injury, and was ineffective against apple mildew and red spider [*Tetranychus telarius*]. The importance of the 'pink-bud' application of lime-sulphur, especially when severe infection with scab occurs early in the season, as in 1930, was also confirmed.

On Beauty of Boskoop apples, two post-blossom applications of 20–10–100 soda-soap solution, 1–100 lime-sulphur, and a sulphur dust, respectively, gave the best results against *P. leucotricha*. It is pointed out, however, that the sulphur dust should be used with caution, as it was of doubtful safety in 1929, although it caused no damage in 1930. Weak 1 in 150 lime-sulphur with 0·1 per cent. gelatine compared favourably with the stronger 1 in 100 spray with 0·4 per cent. lead arsenate but without gelatine, when applied twice post-blossom.

Confirmation was also found of the considerable influence exerted by the rootstock on the susceptibility of the trees to apple mildew, since Cox's Orange Pippin trees worked on East Malling No. I stock were pre-eminently susceptible, while those on Nos. XVI, IV, and XV were resistant. The same is also true, in the main, of the influence of the rootstock on susceptibility to scab, but it appeared to be governed, to some extent, by seasonal conditions.

JANCKE (O.) & LANGE (L.). **Über die Mehltauanfälligkeit unserer Apfelsorten.** [On the susceptibility of our Apple varieties to mildew.]—*Gartenbauwissensch.*, vi, p. 433, 1932. [Abs. in *Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz*, xliii, 2, p. 92, 1933.]

A survey is given of bibliographical references in the relevant horticultural and scientific literature to the reaction of apple varieties to mildew (*Podosphaera leucotricha*), supplemented by the results of eight years' experience with 98 varieties at a branch of the German Biological Institute [cf. *R.A.M.*, ix, p. 668]. No clear-cut correlation of general applicability could be found between climatic conditions and the occurrence of mildew, nor could the statements regarding the dependence of the disease on hot and dry or warm and moist summers be verified [cf. ibid., viii, p. 316]. On the other hand, confirmation was obtained of the prevailing opinion that the disease is more severe among crowded, ill-ventilated espalier plantings than in those of the same age and variety given plenty of space and air.

BAINES (R. C.) & GARDNER (M. W.). **Pathogenicity and cultural characters of the Apple sooty-blotch fungus.**—*Phytopath.*, xxii, 12, pp. 937–952, 2 figs., 1 graph, 1932.

Pure cultures which readily developed pycnospores of the sooty blotch fungus, *Gloeodes pomigena* [*R.A.M.*, x, p. 390; xii, p. 206], were obtained from the tissues of apple and crab-apple (*Pyrus coronaria*) fruits, as well as from the young twigs of 23 other hosts [which are enumerated] in Indiana, including wild blackberry (*Rubus allegheniensis*), *Sassafras variifolium*, red elm (*Ulmus fulva*), hard [sugar] maple (*Acer saccharum*), willow (*Salix nigra*), *Cornus rugosa* and *C. alternifolia*, *Liriodendron tulipifera*, *Cercis*

*canadensis*, white oak (*Quercus alba*), and *Smilax hispida*. Pycnidia with mature bicellular spores were found in late May and early June on the twigs of a number of these hosts and cultures obtained from them.

Under cool, moist conditions inoculations with spore suspensions of the cultures from fifteen of these hosts on green apples were successful in producing typical sooty blotch, the incubation period being two to three weeks. In the orchard infection was produced in one to two months on apples by inoculation with spores from cultures from ten of the above-mentioned hosts. No differences in the type of infection were produced by the cultures from different hosts.

The fungus developed well on a number of agar media, sporulation being promoted by malt and potato extracts. On potato-dextrose agar heaped, black, leathery colonies are formed with an abundance of spores exuding in gelatinous masses. The optimum temperature for growth was found to be about 20° C., a range of 18° to 27° being satisfactory for this purpose. Little or no growth occurred at a humidity of 90 per cent. or less. The fungus tolerates a wide range of hydrogen-ion concentration.

The morphology of *G. pomigena* is described. Below the superficial thallus on the apple cuticle, clusters of short hyphae may be observed penetrating a short distance into the cuticle. No penetration beneath the cuticle was observed. The pycnospores are unicellular when immature, then bicellular or sometimes tricellular. In culture they are formed in numerous cavities, apparently without distinct walls, at different depths in the thallus. On the host they are mostly 10 to 12 by 2 $\mu$ and in culture 12 to 14 by 2 to 3 $\mu$.

KIENHOLZ (J[ESS] R.). **Perennial canker and anthracnose fungi: host relations and cultural differences.**—Abs. in *Phytopath.*, xxii, 12, pp. 995–996, 1932.

*Gloeosporium perennans* [the cause of perennial canker of the apple] was observed in nature on quince trees and fruits and the service berry (*Amelanchier pallida*) [*A. alnifolia*: in the Pacific Northwest] in 1931, while *Neofabraea malicorticis* [the cause of North-Western apple anthracnose: *R.A.M.*, xi, p. 788] occurred on the native Oregon crab-apple (*Malus* [*Pyrus*] *rivularis*). The following plants were successfully inoculated with both fungi: peach, *A. alnifolia*, wild and cultivated cherry, plum, apricot, *P. rivularis*, flowering quince, hawthorn [*Crataegus*], mountain ash [*P. aucuparia*], and rose haws.

Dyes of the tri-phenyl-methane series inhibited spore germination at high dilutions. When malachite green [ibid., xi, p. 525] was incorporated into either potato-dextrose or Coons's synthetic agar at a concentration of 1 in 200,000, the growth of *N. malicorticis* was inhibited from 20 to 90 per cent. more than that of *G. perennans*.

HOCKEY (J. F.). **Gravenstein spot scald.**—*Scient. Agric.*, xiii, 4, pp. 225–227, 1 fig., 1932. [French summary on p. 274.]

A brief account is given of an injury resembling scald which in

1930 developed in a consignment of Gravenstein apples. The lesions appeared in apparently sound fruit after exposure in the shop windows, as circular, depressed, light brown spots centred around a darkened lenticel, and 1 to 10 mm. in diameter, but frequently coalescing to form irregular depressed areas 1·5 to 2 cm. in diameter. The epidermis and 4 to 8 layers of the hypodermal tissue were collapsed and brown.

Spotting more or less typical of this injury was experimentally reproduced in Gravenstein apples which were removed from cold storage and exposed to sunlight for one day, while apples that were kept in subdued light remained normal [cf. *R.A.M.*, xii, p. 179]. It is pointed out that the condition, which is termed 'spot scald', has only been seen on mature apples containing no starch in the pulp cells and practically no sucrose, and that temperature did not appear to have any great effect on its development. When tested for glutathion [ibid., x, p. 667] by White's method (*Science*, N.S., lxxi, pp. 74–76, 1930), before exposure to light, the apples showed a faint pink colour most concentrated immediately below the epidermis and adjoining the vascular bundles, while after exposure the test on sections containing spot-scalded areas gave a very pronounced pinkish-brown colour to the collapsed tissue, extending from immediately below the cuticle to a depth of six or eight layers of cells. This response to the glutathion test from the affected areas is believed to indicate that this or some other compound containing sulphur may be responsible for the trouble.

Childs (L.). **Observations on the increase of the Pear scab fungus.**—*Better Fruit*, xxvii, 6, pp. 5, 12, 1932.

*Venturia pirina*, while frequently serious in pear orchards west of the Cascade mountains in northern Oregon and Washington, was formerly only occasionally found in the more arid parts of southern Oregon and east of the Cascades. During the past three years, however, it has steadily become more widely prevalent in the Hood River Valley district of Oregon. The Anjou variety is the most susceptible, though occasional infections have been noted on Box and Bartlett.

Anjou pears are readily damaged by Bordeaux mixture and liquid lime-sulphur, and the only safe sprays on this variety were found to be dry-mix sulphur-lime, wettable, and atomic sulphur, which failed to control the disease. Good results were, however, obtained by ploughing in the fallen leaves, which was fully as effective as spraying.

Daily observations for two years showed that, even when only a little rain fell, spores were discharged from fallen leaves; with each shower from late February until September spores were liberated from old fallen leaves [see above, p. 296].

Childs (L.). **Observations on the ascospore discharge of Pear-scab fungus, Venturia pyrina.**—Abs. in *Phytopath.*, xxii, 12, p. 997, 1932.

Perithecia very similar to those of *V. pirina*, except in the apparent absence of setae, were observed in scabbed pear twig

lesions in Oregon and provisionally identified as those of *Mycosphaerella tulasnei*, the imperfect stage of which is a *Cladosporium* [*R.A.M.*, x, p. 194]. Both organisms discharge their ascospores only during rainy periods until at least as late as July [see preceding abstract]. In 1932 the first spores of *M. tulasnei* were liberated on 26th March. Wherever the latter fungus occurs on fallen leaves, scab perithecia are extremely rare or absent, even though scab lesions may be present.

HOUDAYER (C.). **Traitements d'automne et d'hiver des arbres fruitiers.** [Autumn and winter treatments of fruit trees.]—*Journ. d'Agric. Prat.*, xcvi, 52, pp. 524–526; 53, pp. 543–544, 1932.

Full directions are given for the dormant treatment of fruit trees against insect pests and fungous diseases in France [*R.A.M.*, xi, p. 655]. Shot hole of stone fruits (*Coryneum*) [*Clasterosporium carpophilum*] may be combated by an application in November of Bordeaux mixture (2 per cent. copper, 3 per cent. lime), followed by a winter treatment in fair, quiet weather, with Bordeaux-oil emulsion (2 kg. copper sulphate, 3 kg. hydrated lime, 8 l. anthracene oil, and 90 l. water). Knapsack sprayers with a 15 l. content, suitable for small orchards, should be worked at an initial pressure of 6 kg., decreasing to 3 kg.; with other types pressures of 12 to 4 kg. are practicable.

JOËSSEL (P. H.) & ANRÈS (M.). **Résultats des essais de traitement contre le Coryneum de l'Abricotier dans la région de Barroux (Vaucluse) au cours des années 1931 et 1932.** [Results of experiments on the control of the Apricot *Coryneum* in the region of Barroux (Vaucluse) in 1931 and 1932.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 8–9–10, pp. 253–255, 1 pl., 1932.

In the valley of the Rhone apricot trees are stated to be seldom attacked during winter by *Coryneum* (*Clasterosporium carpophilum*) [see preceding abstract], but the fungus is important in that it frequently disfigures the fruit, the market price of which in 1932 was reduced in many cases from 450 or 500 frs. to 80 or 100 frs. per 100 kg. Good control of this disease and also of *Sclerotinia cinerea* [see next abstract] was obtained in 1931 and 1932 by spraying the trees with 2 per cent. Bordeaux or Burgundy mixtures, or with 0·5 per cent. neutral copper acetate spray. The last-named treatment, in particular, gave fruits that obtained in both years the highest price on the local market, owing to their exceptional quality.

ANRÈS (M.) & JOËSSEL (P. H.). **Observations sur l'apparition et le développement du Monilia de l'Abricotier en 1931 et 1932 dans les communes de Saint-Hyppolite, Caromb et Le Barroux (Vaucluse). Méthode de lutte employée et résultats obtenus.** [Notes on the appearance and development of the Apricot *Monilia* in 1931 and 1932 in the communes of Saint-Hyppolite, Caromb, and Le Barroux (Vaucluse). Results

obtained by the control methods used.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 8–9–10, pp. 248–252, 1932.

Observations on the incidence and development in 1931 and 1932 of the *Monilia* (*Sclerotinia cinerea*) disease of apricot trees in three localities of Vaucluse [*R.A.M.*, xi, p. 791] showed that infection chiefly occurred on trees that blossomed during rainy and foggy periods, the first symptoms appearing eight or ten days after petal fall. No differences in the relative resistance of the varieties commonly grown were observed, and the fact that the Blanc-rosé variety was comparatively immune in both years was probably due to its flowering in fair-weather periods. The necessity of keeping the trees in a good sanitary condition and of pruning them properly was well demonstrated by the fact that neglected trees were badly diseased and did not respond to spraying with 2 per cent. Bordeaux mixture, which was fully effective on well-kept trees. The spraying schedule recommended is one application when the buds begin to burst, a second about the time of blossoming, and a third at the moment when the corolla drops off the young fruit.

FISCHER (R.). **Versuche zur Bekämpfung der Blattranddürre der Johannis- und Stachelbeeren in Österreich.** [Experiments in the control of leaf scorch of Currants and Gooseberries in Austria.]—*Ernährung der Pflanze*, xxviii, 24, p. 440, 1932. [English summary on p. 456.]

Good control of leaf scorch in currant and gooseberry bushes [*R.A.M.*, xi, p. 463] was given in experiments during 1930–1 by the application to the soil of potassium sulphate at the rate of 150 gm. per sq. m. Even at 75 gm. per sq. m. the potash fertilizer effected a noticeable improvement in the state of the bushes, whereas those receiving smaller quantities or none developed the typical deficiency symptoms. A marked decline in susceptibility to the leaf fall due to *Pseudopeziza ribis* also followed the treatment.

CHABROLIN (C.). **Contribution à l'étude des maladies des arbres fruitiers en Tunisie.** [A contribution to the study of fruit tree diseases in Tunis.]—*Ann. du Service Bot. et Agron. de Tunisie*, ix, pp. 177–200, 8 pl., 1932.

The following are the chief diseases of Tunisian fruit trees discussed in this paper. Oranges are liable to stem rot (*Polyporus* [*Fomes*] (?) *fulvus* [*R.A.M.*, ix, p. 188] and other Polyporaceae); root rot (*Armillariella* [*Armillaria*] *mellea*) [ibid., xi, p. 40]; gummosis (*Phytophthora citrophthora* and *P. parasitica*); shell bark (*Phomopsis californica*) [*Diaporthe citri*: ibid., xii, p. 213]; psorosis [ibid., xii, p. 89]; anthracnose (*Colletotrichum gloeosporioides*) [*Glomerella cingulata*]; blast (*Bacterium* [*Pseudomonas*] *syringae*) [ibid., xi, p. 249]; and various organisms infecting the fruit, of which *Penicillium digitatum* and *P. italicum* are the most common.

Date palms suffer from the 'medjnoon' or 'fool' disease caused by *Thielaviopsis* [*Ceratostomella*] *paradoxa* [ibid., xi, p. 572] and are also subject to infection by *Diplodia natalensis*, *Phomopsis*

*phoenicicola*, and 'dry bone' [loc. cit.]. Palm wine is prepared from the palms attacked by *Mauginiella scaettae* [ibid., x, p. 654] or otherwise prevented from yielding good dates.

**El 'mal de Panama' enfermedad vascular de la planta del Platano. Legislacion Mexicana y extranjera sobre el Platano.** [The 'Panama disease' a vascular disease of the Banana plant. Mexican and foreign legislation concerning the Banana.]—*Ofic. Def. Agric. Estados Unidos Mexicanos Bol. de Divulg.* 15, 56 pp., 9 col. pl., 4 figs., 1932.

At the beginning of 1928 symptoms of Panama disease (*Fusarium cubense*) [*F. oxysporum cubense*] developed in certain Mexican banana plantations, but not until the middle of 1931 was the causal organism identified by Wollenweber [*R.A.M.*, xi, p. 463].

The external and internal symptoms of the disease are described, with notes on predisposing conditions, varietal susceptibility, control, and legislation. Most of the varieties belonging to *Musa sapientum* have been found susceptible to Panama disease, including Gros Michel [cf. ibid., xii, p. 104], also known by various local names, e.g., Pouyat, Bluefield, and Tabasco, and the 'red' banana, while *M. Cavendishii* and its varieties 'white' and 'dwarf' are resistant. Experimental work on the development of resistant varieties with good commercial qualities is in progress. Discussing control measures, it is stated that the most suitable soil type for banana cultivation is composed as follows: clay 40 per cent., sand 52 per cent., humus 5 per cent., and lime 3 per cent. Directions are given for cultural operations, fertilizing, the destruction of infected rhizomes by gas-oil [ibid., xi, p. 585], and other means of combating the disease.

The Mexican and foreign legislation relating to Panama disease is summarized. Foreign quarantine No. 7 of 27th December, 1927, prohibiting the importation into Mexico of banana plants or any part thereof [ibid., vii, p. 416] was modified (30th May, 1928) to permit the entry of banana fruits for consumption into certain isolated districts in the northern region of Lower California, whence there is considered to be no risk of a spread of infection to the interior.

MEHRLICH (F. P.). **Physiology and pathogenicity of species of Phytophthora that cause heart rot of Pineapple plants.**—Abs. in *Phytopath.*, xxii, 12, pp. 1001–1002, 1932.

Heart rot of pineapples in Hawaii is stated to be caused by *Phytophthora cinnamomi* [*R.A.M.*, xii, p. 106], *P. meadii*, *P. melongenae* [ibid., x, p. 740], and *P. parasitica* [ibid., xi, p. 625]. Newly-found hosts of these fungi include common weeds and green manures, which may enable them to persist in the absence of pineapples. Three of the above-mentioned organisms may also produce a rot of green pineapple fruits.

MEHRLICH (F. P.). **The fungicidal control of Phytophthora rot of Pineapple plants.**—Abs. in *Phytopath.*, xxii, 12, p. 997, 1932.

In experiments in the control of the *Phytophthora* heart rot of

pineapple in Hawaii [see preceding abstract], Bordeaux 1-0·65-3 as a dip proved to be an effective and economical preventive, being superior to the other 21 liquid and 12 dry fungicides tested. A single dipping in eight separate trials gave an average of 79·23 per cent. control (63·40 to 91·59) under conditions highly favourable to the development of the disease, the amount of infection in the adjacent untreated plots ranging from 22·70 to 84·99 per cent. (average 48·8).

CARTER (W.). **Comparison of Tobacco dust with other forms of nicotine in control of yellow spot disease of Pineapples.**—*Journ. Econ. Entom.*, xxv, 5, pp. 1031–1035, 1 diag., 1933.

Compared with seven other forms of nicotine, tobacco dust (1·2 per cent.) proved definitely superior in the control of yellow spot of pineapples in Hawaii [*R.A.M.*, xi, p. 586]. The incidence of the disease was found to be correlated with the growth and succulence of the plants, yellow spot being less in the poorly growing areas of the field. The relatively slight incidence of the disease in the tobacco-dusted plots is thought to be due to the retardation of growth and toughening of the tissues resulting from the applications, rather than to any direct insecticidal effect on the vector, *Thrips tabaci*.

VAN POETEREN (N.). **Bestuiven en bestuivers.** [Dusting and dusting apparatus.]—*Versl. en Meded. Plantenziektenkundigen Dienst te Wageningen*, 67, 24 pp., 8 pl., 1932.

A brief account of the history of dusting for insecticidal and fungicidal purposes is followed by a discussion of the merits of this process as compared with spraying; notes on insecticidal, fungicidal, and combined dusts; the various types of apparatus in current use; the risks of injury to plants and the dangers to man and livestock arising from dusting; and the applicability of this form of treatment to various pests and diseases.

Under Dutch conditions dusting has generally been found less efficacious on the whole than spraying, but it often gives very satisfactory results and may be recommended as a supplementary treatment or even as a substitute for spraying where the latter operation is impracticable. The use of a good dusting machine, preferably of the motor type, is essential to success. The various methods of dusting and types of apparatus are clearly illustrated by 26 very good photographs. [This circular is also published in *Tijdschr. over Plantenziekten*, xxxviii, 11, pp. 229–252, 1932.]

HACHIYA (T.) & NISHIMURA (J.). **Action of some aromatic sulfur compounds upon pathogenic fungi.**—*Journ. Pharm. Soc. Japan*, lii, pp. 756–766, 1932. [English translation, pp. 89–91. Abs. in *Chem. Abstracts*, xxvii, 4, pp. 798–799, 1933.]

Potassium thiobenzoate possesses greater fungicidal activity than the sodium compound, and potassium β-thionaphthoate much greater. Urea exerts no positive action on pathogenic fungi [unspecified], thiourea being moderately active and phenylthiourea powerfully so. Among the aromatic sulphur compounds prepared, phenylthiourethan was the most active in this respect. Trypaflavin

was superior to phenylthiourethan, while mercuric chloride was almost equally effective with diphenylthiourea.

MARTIN (H.). **The present uses and future development of spray spreaders.**—*H*[*ortic.*] *E*[*ducational*] *A*[*ssoc.*] *Year Book*, i, pp. 76–84, 1932.

To avoid ambiguity the term 'spreader' should be restricted to those substances, such as soft soap, casein derivatives, gelatine, and (in less common use) resinates and saponin [*R.A.M.*, xii, p. 26], which serve to improve the wetting and spreading ability of spray fluids. Materials which improve spray retention, such as flour paste, dextrins, and gums, should be classed as 'stickers'. So-called spreaders may also function as protective colloids which, by delaying the sedimentation of spray suspensions, contribute to the even distribution of the toxic agent.

In this connexion, it is pointed out that soft soap added to Bordeaux mixture (10–10–100) at the rate of 5 to 10 lb. per 100 galls. is entirely converted to calcium soap; as the calcium soap is insoluble, the mixture completely lacks the wetting and spreading qualities of the soft soap solution. The calcium soap does, however, function as a sticker. Gelatine (1 in 100) acts as a sticker and a protective colloid, but the wetting and spreading qualities of the solution are poor. Not until the concentration of gelatine reaches at least 5 in 100 does the solution wet the conidiophores of the hop powdery mildew fungus [*Sphaerotheca humuli*] as readily as soft soap at a like concentration. Further, to act as a good wetter the solution must be fresh, while to act as a good sticker it must be kept until it attains high viscosity.

Notes are given on the chemistry and application of agrals [ibid., xi, pp. 679, 732], sapamines (obtained from the Society of Chemical Industry, Basle), sulphite lye [ibid., xi, p. 464], and by-products of oil refinement. The possibility of using oil sludge or of isolating suitable spreaders from it is worth investigation. A further line of possible development is the use of organic liquids in the form of spray emulsions, hydrocarbon and glyceride oils [loc. cit.] being possibly capable of extended use. The paper concludes with some practical notes on the use of spreaders.

TORNOW (ELISABETH). **Eine Schnellmethode zur Prüfung von Salben und Chemikalien auf Quecksilber.** [A rapid method for the examination of ointments and chemicals for mercury.] —*Angew. Chemie*, xlv, 45, pp. 707–708, 1932.

The writer describes the application of her method for the determination of mercury (based on the oxidation of aluminium in sodium thiosulphate) [*R.A.M.*, xi, p. 706; xii, p. 152] to a number of medicinal and cosmetic ointments and some standard liquid and dry seed-grain disinfectants.

Mercury was present in agfa [ibid., vii, p. 300], germisan (cyanmercuricresol), gerstenfusariol, roggenfusariol (mercuric chloride), sublimoform (mercuric chloride and formalin), weizenfusariol (mercuric chloride and copper sulphate), and uspulun-universal (an arsenical compound and chlorphenolmercury) among the liquid preparations tested, as well as in the following dusts: abavit B

(mercury iodide), betanal, ceresan, tillantin R, trockenfusariol, and tutan (mercury and copper). The following preparations were free from mercury: 'Saatbeize für Roggen' (copper sulphate and ferric sulphate), segetan-nassbeize (silver cyanide and copper oxide ammonia) [ibid., v, pp. 154, 540, *et passim*], hafertillantin, porzol (bismuth and copper) [ibid., v, p. 172], and tillantin (arsenic).

SCHOUTEN (A.). **Der Pflanzenschutzdienst in Holland und seine Organisation.** [The plant protection service in Holland and its organization.]—*Nachricht. über Schädlingsbekämpf.*, vii, 4, pp. 117–130, 6 figs., 1932.

An account is given of the organization and progress of the Dutch Plant Protection Service since its inception in 1899 [*R.A.M.*, x, p. 536]. The service functions through the head office at Wageningen and a number of provincial branches, the latter administered by technical officers posted throughout the chief growing and exporting districts of Holland, and concerned, *inter alia*, with such seasonal activities as bulb, potato, and gooseberry inspections. In 1930 the number of certificates issued with goods for export amounted to 141,314; 397,468 parcels of certificated bulbs for export weighing over 35 kg. were inspected, the corresponding figures for those from 10 to 15 and below 10 kg. being 79,320 and 258,540, respectively. The number of inspected consignments (large and small) of bulbs imported into Holland was 9,680 and of miscellaneous plants 41,306; inspections of fruit consignments for export totalled 2,980, of vegetables 557, of onions and shallots [*Allium ascalonicum*] 9,404, of potatoes 384,864,496 kg., and of gooseberries, 635,942 kg.

LAVROFF (N. N.). Определитель растительных паразитов культурных и дикорастущих полезных растений Сибири. Выпуск I. Полевые, огородные, бахчевые, и технические культуры. [Key for the identification of vegetable parasites of cultivated and wild useful plants of Siberia. Part I. Field, kitchen garden, cucurbitaceous, and technically useful crops.]—140 pp., 91 figs., Publishing Office "Kouboutch", Tomsk, 1932.

This is a list, arranged in alphabetical order, of the common Russian names of the hosts, of the most important fungal and bacterial (and a few virus) diseases of cultivated crops, which have been so far recorded in Siberia. For each host a key is given for the identification of the diseases or pathogens, indicating the main external symptoms, and with brief notes on the parasites, some morphological details of which are also given in many cases. Special mention may be made of a virus disease of oats (a fuller description of which is given in Bondartzeff's text-book of Diseases of Cultivated Crops and their Control [*R.A.M.*, xii, p. 182]) which, according to V. S. Dontchenko, finds its expression in three different modifications of the host plant, namely, (*a*) general or partial viviparity, (*b*) stunting either by a shortening of the internodes or the production of fewer internodes, and (*c*) exaggerated tillering; these conditions were observed to occur in various combinations on the same plants. The disease is not transmissible by the seed, but is carried in the soil, and was observed to pass from

oats to wheat, barley, spring-sown rye, maize, proso (*Panicum miliaceum*), and soy-beans. It is distributed over the whole of Siberia from the Urals to the Pacific coast.

A powdery mildew of lentils, which the author distinguishes as a new biological form *ervi* of *Erysiphe communis* [*E. polygoni*], is characterized by conidia 27 to 37 by 13 to 18 $\mu$ in diameter, rounded, dark brown perithecia 108 to 135 $\mu$, containing 7 to 10 asci measuring 48 to 54 by 23 to 36 $\mu$, and ellipsoidal ascospores, 4 to 6 to each ascus, measuring 24 to 27 by 13·5 $\mu$. A Russian description and Latin diagnosis are also given of a new species of *Puccinia*, which is named *P. hordeina* Lavroff n. sp., on barley. The uredosori are amphigenous, dispersed, minute, oblong, 320 to 720 by 110 to 160 $\mu$; yellow to rusty-yellow; the uredospores are subglobose, echinulate, yellow, 16 to 27 by 16 to 22 $\mu$, with 3 or 4 pores. The black, subepidermal teleutosori develop chiefly on the leaf sheaths, very rarely on the under side of the leaves; they frequently coalesce to form irregular lines up to 5 mm. in length; the teleutospores are oblong-clavate, two-celled, with a rounded or truncate apex, slightly constricted in the middle, brown, and 37 to 89 by 11 to 27 $\mu$; the distal cell is of a darker colour, shorter, and thicker than the basal which terminates in a short, detachable pedicel. The paraphyses are brownish. Mesospores are also present in small numbers, and are smaller than the teleutospores. This rust was only found in western Siberia and in the Altai foothills.

PALM (B. T.). **Algae as additional hosts of pathogens to angiosperms (preliminary note).**—*Zentralbl. für Bakt.*, Ab. 2, lxxxvii, 9–12, pp. 229–233, 1932.

In support of his view that the lichen fungi are parasites on the algal hosts, on which they form sclerotia or stromata, the writer cites experiments establishing the parasitism of *Rosellinia necatrix* and *Pythium mamillatum* [*R.A.M.*, x, p. 487] on various algae.

Small quantities of aerial mycelium of *R. necatrix* from a fresh subculture were applied to vigorously growing mats of *Vaucheria* and *Hydrodictyon* spp. in Petri dishes, the former with and the latter without adhering soil. The fungus made extensive growth on the *Vaucheria*, penetrating the algal filaments and destroying the chlorophyll in the protoplast, where products of fatty degeneration were perceptible. The *Hydrodictyon* was similarly but less extensively penetrated by the fungus, which further parasitized a species of *Cladophora*. Inoculation experiments on *Vaucheria*, *Cladophora*, and several Chlorophyceae and Cyanophyceae showed that *Gibberella saubinetii* (*Fusarium* stage) [*F. graminearum*], *Cylindrocarpon mali* [*Nectria galligena*: cf. ibid., vii, p. 677], and other fungi can act as parasites on one or more of the abovementioned algae.

A similar experiment with *Pythium mamillatum* on *Cladophora* and *Gloeocapsa* spp. in Petri dishes and hanging drops also resulted in the partial or total disorganization of the host cells, a few of which were found to contain the oospores of the fungus; these were mostly formed, however, outside the host.

FISCHER-PIETTE (E.), HEIM (R.), & LAMI (R.). **Note préliminaire sur une maladie bactérienne des Zostères.** [Preliminary note on a bacterial disease of the *Zosterae*.]—*Comptes rendus Acad. des Sciences,* cxcv, 26, pp. 1420–1422, 1932.

During the winter of 1931–2 the vast tracts of the grass-wrack seaweed (*Zostera marina*) in the Saint-Malo region (Brittany) were suddenly destroyed by a bacterial disease, which is stated to have been also reported on the same host in other parts of the French Atlantic coast and from Holland, Canada, and the United States (whence it is thought to have been introduced into Europe). After a partial recovery during the summer of 1932, the plants began to show signs of the same trouble in November. Considerable importance attaches to the disease owing to the many economic uses of the host, e.g., for manure, stuffing, packing, and the like.

The first symptom is the appearance of grey to brownish spots at the apex of the leaves, converging and extending downwards to the sheaths and rhizomes, on which the spots are brown or black. Ultimately the branches become entirely blackened and torn and decayed rhizomes are readily broken.

Bacteria were observed in the diseased leaves and also in the vascular bundles, the sclerotic fibres, and in spaces left between the cells by the dissolution of the middle lamella. They were isolated in pure culture and found to be rod-shaped, Gram-negative, and to measure 1·5 to 4 by 0·5 $\mu$. Further studies are in progress.

BEAUVERIE (MARIE A.). **Les maladies à ultravirus des plantes.** [The ultra-virus diseases of plants.]—*Ann. du Service Bot. et Agron. de Tunisie,* ix, pp. i–ii, 1–175, 8 pl., 1932.

In this comprehensive survey of the virus diseases of plants in the light of contemporary research, the writer discusses the subject under the following aspects: (1) characteristics of the virus diseases as a group apart from those due to bacteria, fungi, and other agents, or to ecological factors; (2) technique of preparation and examination of the sap extracts of affected plants; (3) nature of the causal agent of virus diseases (considerations on the bacterial, protozoan, enzymatic, and filterable or ultra-virus theories); (4) difference between infectious and non-infectious chloroses; (5) pathological histology and cytology of diseased plants; (6) natural and artificial transmission of virus diseases; (7) a study of some virus diseases attacking economic plants; (8) analysis and synthesis of the viruses; (9) relationships between the virus diseases of plants and of animals.

Each section is followed by a list of authors, with the number under which their papers appear in the supplementary bibliography of the relevant literature, comprising 762 titles.

FERGUSON (J. H.). **The particle size of biological units. A review.** —*Journ. Physical Chem.,* xxxvi, 12, pp. 2849–2861, 1932.

A review is given of the literature concerning the particle size of the biological units of the filterable viruses, the bacteriophage of the Twort-d'Hérelle phenomenon, and the genes constituting the ultimate physical units of heredity. The data thus assembled are considered to afford a very slender foundation for definite con-

clusions as to the nature of the units in question. Generally speaking, these units are rather too large to reconcile with the physico-chemical facts regarding the largest known or suspected molecules. The lowest estimate of bacteriophage size (5 mμ) approximates to Svedberg's values for the haemoglobin molecule (Colloid Chemistry, 2nd Ed., 1928); an average figure of 50 mμ in diameter for biological entities means a volume of a thousand times as great, with room for many hundreds of protein molecules. One of the current conceptions of the basis of life is that of a self-perpetuating catalyst of molecular (? protein) size. Such speculations are, however, considered to be fruitless until the entities under discussion are definitely established by physico-chemical data on the one hand, while on the other the biologist recognizes their 'vital' powers of reproduction, assimilation, and adaptation [cf. *R.A.M.*, xi, pp. 734, 751].

A table is given showing the estimated particle size of the biological units of various human and animal virus diseases and tobacco mosaic (30 mμ) [cf. ibid., xi, p. 735], with the authority, date, method of calculation, and a suitable object of comparison in each case. A bibliography of 83 titles is appended.

Peyronel (B.). **Absence de mycorhizes chez les plantes insectivores et hémiparasites, et signification probable de la mycorhizie.** [Absence of mycorrhiza on insectivorous and hemiparasitic plants and probable significance of the mycorrhizal relationship.]—*Boll. Sez. Ital. della Soc. Internaz. Microbiol.*, iv, 11, pp. 483–486, 1932.

After suggesting that if mycorrhizal fungi are parasitic then they should be found as readily on the roots of insectivorous and hemiparasitic plants as on those of other plants in the same locality, the author states that *Drosera rotundifolia* and *Pinguicula vulgaris* growing in damp situations showed no trace of mycorrhiza, though *Viola palustris*, *Potentilla tormentilla*, and various grasses in the immediate vicinity were markedly affected. Similarly, no mycorrhiza was found on the hemiparasites *Euphrasia officinalis*, *E. minima*, *Rhinanthus major*, *Melampyrum pratense*, *Odontites serotina* [*Bartsia odontites*], and *Thesium alpinum*, all of which except *B. odontites* grow in the fields or woods in the Piedmontese mountains; *B. odontites* was growing in rye fields where the rye and various wild grasses showed the abundant presence of mycorrhizal fungi. Typical endotrophic mycorrhiza of the *Endogone* or phycomycetoidal type [*R.A.M.*, iv, p. 755] were observed on the non-parasitic Scrophulariaceae, *Veronica officinalis*, *V. allionii*, *V. fruticulosa*, *V. chamaedrys*, *V. urticifolia* [*V. praecox*], *Linaria vulgaris*, and *Digitalis ambigua* growing in the same stations. The holo-autotrophic plants examined by the author, invariably, and the hemiparasitic ones frequently, showed the presence of the mycelium of a weakly parasitic *Rhizoctonia*. Plants of *Euphrasia* growing in damp places near ditches frequently showed a Chytridiacean fungus, differing in some respects from *Asterocystis radicis*, in the epidermal cells of the roots [ibid., iii, p. 539].

The author considers that these observations support the view that mycorrhizal formation is related to nitrogenous food supply.

From the information at present available it appears that the mycorrhizal relationship has its greatest development in soils poor in soluble nitrogenous material (nitrates and ammoniacal salts), but rich in organic matter. Plants growing in cultivated land are those which least frequently show mycorrhiza; the author's own experience demonstrated that if wheat is sown in meadow land or pasture its roots are completely invaded by mycorrhizal fungi, but that if it is sown in soil to which fertilizers (such as nitrate of soda or lime) have been added, very few of the roots have any mycorrhiza.

FRASER (LILIAN). **An investigation of Lobelia gibbosa and Lobelia dentata. I. Mycorrhiza, latex system and general biology.** —*Proc. Linn. Soc. New South Wales*, lvi, 5, pp. 497–525, 44 figs., 1 graph, 1931.

A comprehensive account is given of the writer's investigations (incorporating the earlier researches of Miss A. Rennie) on the mycorrhiza, latex system, and general biology of *Lobelia gibbosa* and *L. dentata* in New South Wales and South Australia.

The mycorrhiza of the laticiferous plants under observation is of an unusual type. The minute seeds germinate at a considerable depth below the soil and are obliged to rely on the fungus for their nutrition in the early stages of growth, during which they are regarded as holoparasites on the fungus, as they have no root hairs and no leaves. Strands of fungal hyphae resembling rhizomorphs are invariably found associated with the hypocotyl region of young seedlings, spreading out to form a mat over the surface and in places penetrating the cortex by growing down between the cells, especially of the outer layers, which are almost completely surrounded by the hyphae. The hyphae composing the outer part of the fungal mat are narrow, thick-walled, closely septate, and interwoven, while the inner ones and those invading the root are greatly enlarged, thin-walled, and densely protoplasmic. The strictly intercellular fungus evidently infects the young primary root as soon as the latter commences growth, keeping pace with its development and also penetrating all the lateral roots and their branches. It is found in all the cell layers of the cortex, the cells of the infected regions being markedly enlarged transversely. Except in places where branching occurred, only one point of entry into the root could be found for any one fungus strand, so that penetration is evidently effected by a modification of the growing point of the rhizomorph.

Three stages can be distinguished in the association of the mycorrhizal fungus and the *Lobelia* root cells. (1) The period of fungal invasion, when the slender, densely protoplasmic hyphae may be seen growing down between the cortical cells. (2) The period of fungal enlargement in the middle cortex, during which an accumulation of oil drops takes place in the fungal cells and those of the cortex are forced apart. (3) The period of fungal depletion from the inner cortical zone outwards, characterized by the disappearance of all reserve food from the hyphae and the

aggregation in the peripheral cytoplasm of the adjacent cells of numerous minute drops of reserve food giving the reactions of an oil or fat. During this process the outer cortical cells gradually expand and practically crush the fungus, only a few living hyphae of which remain in the external layers. Food material is evidently extracted from the cortical cells by the fungus and vice versa by osmosis, since no trace of haustoria could be detected.

Attention is drawn to the difference between the *Lobelia* mycorrhiza and the ectotrophic type, in which the mycelium forms a thick mat over the root surface and penetrates it at all points. The organism under discussion also differs from the endotrophic type producing arbuscules [see next abstract] which are digested by the cells they invade, and from the orchid mycorrhiza with its exclusively intracellular hyphae serving as nutriment to the higher plant [*R.A.M.*, xi, p. 317].

McLuckie (J.) & Burges (A.). **Mycotrophism in the Rutaceae. I. The mycorrhiza of Eriostemon crowei F. v. M.**—*Proc. Linn. Soc. New South Wales*, lvii, 5–6, pp. 291–312, 22 figs., 1932.

After stating that the authors have detected endotrophic mycorrhiza in *Zieria smithii*, *Eriostemon crowei*, *E. lanceolatus*, and in the genera *Boronia* and *Correa*, of the Rutaceae (a family with which the mycotrophic habit had not been hitherto associated), details are given of the cytological examination of the mycorrhiza of *E. crowei*, with which those in the other species studied are stated to be in close agreement. The roots are infected by two different fungi, the first of which forms a network of branched, septate, brown hyphae with thick walls and scanty cell contents, on the surface of the root, adhering to the epidermal cells. These hyphae develop swellings resembling appressoria, from which the infecting hyphae arise. Entry of the latter is readily effected through the epidermis, in the cells of which they frequently form coiled masses of thin-walled, non-septate hyphae with sparse contents. In the cortex the fungus advances both transversely and longitudinally, chiefly along the intercellular spaces. The cortical hyphae are irregular, thin-walled, with occasional septa, an abundant granular cytoplasm, numerous nuclei and fat masses, and they send branches into the cells to form arbuscules, both simple and complex, and, later, groups of sporangioles. The latter are not confined to any particular region of the cortex, but occur in all cell-layers between the epidermis and endodermis. The fats, which stain with osmic acid, at first are distributed in the hyphae, in the arbuscules, and in the developing sporangioles, but ultimately accumulate in the last-named organs (which appear to be formed by a swelling of the ends of the branches of the arbuscules), and are later liberated by bursting of the sporangioles into the host cell cavity, sometimes forming several very large, apparently homogeneous globules. Still later the fat globules no longer stain with osmic acid, indicating that they have changed in composition, and finally they disappear, being probably used by the host. Large fat globules also occur in uninfected cells of the epidermis.

All these processes were observed in very small seedlings, as well as in mature plants in full flower and fruit, unlike McLennan's observations of the mycorrhizal endophyte of *Lolium* [*R.A.M.*, v, p. 379], in which the disappearance of the fats was correlated in time with the flowering and fruiting period of the host. Apart from this, however, there is a striking parallelism between these two endophytes in their relation to the higher plant. Vesicles are also developed by the endophyte, chiefly in the intercellular spaces of the outer cortex, but occasionally within a cortical cell; they are usually terminal, occasionally intercalary or lateral, average 68 by 53 $\mu$ in diameter, and contain a large amount of cytoplasm, numerous fat masses, and nuclei. Later they develop a thick wall, become vacuolated, and finally lose all their contents to the vegetative hyphae or the sporangioles. No suggestion of spore formation within them was given and the resemblance to *Endogone* emphasized by Peyronel [see preceding abstracts] is confirmed by the authors. Eventually the remnants of the sporangioles and hyphae inside the host tissues are reduced to a structureless or occasionally reticulate residuum which remains in the cell. After liberation of the fat from the sporangioles, the host nucleus increases in volume and shows marked chromatic increase but no structural hypertrophy. It is suggested that in the early stages of the association the fungus is parasitic, but that later the host plant gets the upper hand.

The second endophyte, which is a *Rhizoctonia* form with moniliform hyphae and no vesicles or arbuscules, occurs in the epidermis and cortex of the roots; this form was isolated from the roots, while the arbuscule-forming fungus has not yet been isolated. It appears to be very like the *Rhizoctonia* isolated by Peyronel from wheat [ibid., iii, pp. 291, 539].

KREBBER (O.). **Untersuchungen über die Wurzelknöllchen der Erle.** [Investigations on the root nodules of the Alder.]—*Arch. für Mikrobiol.*, iii, 5, pp. 588–608, 2 figs., 1932.

The writer's laboratory and field investigations here recorded were carried out at Münster, Westphalia, and were directed to determine the nature and functions of the root nodules of alder (*Alnus glutinosa* and *A. incana*) [*R.A.M.*, x, p. 476]. They confirmed Hiltner's observations (*Landw. Versuchsstat.*, xlvi, p. 153, 1896; *Naturw. Zeitschr. Land. u. Forstw.*, i, p. 17, 1903; ii, p. 336, 1904, the last paper with F. Nobbe) that the relationship between the host and the endophyte is symbiotic, the latter assisting the assimilation of molecular nitrogen by the trees.

The endophyte was found to be a unicellular organism with slender, finely granular hyphae, which form a tangle in the infected cells and develop 'vesicles' at their apices. In the later stages of the partnership the endophyte seems to be almost entirely absorbed by the host cells.

Cytological observations indicate that the endophyte which causes the nodules is a species of *Actinomyces*, but all attempts to obtain it in pure culture gave negative results.

Dickson (J. G.). **Studying the effect of environment upon the development of parasitic diseases and selecting for disease resistance presents problems in co-operation in research.**—*Scient. Agric.*, xiii, 4, pp. 213–224, 5 figs., 1932. [French summary on p. 273.]

The author states that recent attainments in the study of the bearing of environmental factors on the constitution of plants and on their reaction to parasitic diseases, as well as in breeding plants for resistance to diseases, distinctly point to the necessity of such work being carried out in close co-operation between plant biologists, physiologists, and chemists. By way of illustration he gives a progress report on the results obtained in such co-ordinated investigation of the interrelation existing between controlled environmental conditions and the susceptibility of wheat and maize to seedling blight (*Gibberella saubinetii*) [*R.A.M.*, vii, p. 777; xi, p. 171].

Silberschmidt (K.). **Studien zum Nachweis von Antikörpern in Pflanzen II. Teil B. (Beiträge zur Frage der Resistenz und Immunität von Pflanzen gegenüber dem infizierenden Agens der Viruskrankheiten).** [Studies on the detection of antibodies in plants. II. Part B. (Contributions to the problem of resistance and immunity in plants in relation to the infective principle of the virus diseases).]—*Beitr. Biol. der Pflanzen*, xx, 2, pp. 105–178, 1932.

A comprehensive and fully tabulated account is given of the author's studies on the occurrence in tobacco plants of antibodies conferring immunity from mosaic [cf. *R.A.M.*, x, pp. 563, 689], preceded by a survey of the relevant literature.

The first point to be decided was whether natural resistance to tobacco mosaic actually exists in certain plants to the extent assumed by some investigators; in this connexion it was necessary to determine, by serological methods, the occurrence of antibodies in the resistant partner of a graft between a mosaic stock and healthy scion [cf. ibid., x, p. 539]. Experiments were further carried out on the active and passive immunization of tobacco plants against the mosaic virus [cf. ibid., xii, p. 43].

The tobacco plants used in the tests all belonged to a pure line of the Maryland Broadleaf variety. The seeds were germinated in dishes on damp filter paper; after a few days the seedlings were transferred to small clay saucers containing finely sifted soil, whence they were subsequently removed to wooden frames with glass lids, the sides being covered with gauze to exclude insects.

As a rule the inoculations were made by gently rubbing a drop (0·03 c.c.) of the virus from a sterilized pipette on a leaf of the test plant. The virulence of the extract was mostly estimated by Holmes's method on *Nicotiana glutinosa* seedlings [ibid., viii, p. 138]. The infective principle originated in a mosaic tobacco plant from the Bavarian Institute of Agriculture and Plant Protection. It produces on tobacco the typical mosaic symptoms as described by Allard (*U.S. Dept. of Agric. Bull.* 40, 1914) and causes a slight leaf spotting and curling of the pinnae in tomatoes and local necroses on *N. glutinosa* and *Datura stramonium* leaves;

on the other hand, *Atropa belladonna*, *Phytolacca decandra*, and *Lycium barbarum* failed to react to inoculation with the virus, which evidently corresponds to Johnson's 'tobacco virus 1' [*R.A.M.*, vi, p. 501].

The mosaic virus was detected sporadically in scions of *L. barbarum*, *A. belladonna*, and tomato grafted on mosaic tobacco, as shown by the more or less extensive necroses produced by the expressed sap of these scions on *N. glutinosa*. The tomato sap was the most virulent, indicating that the tobacco mosaic virus from the stock had not only penetrated the scion but multiplied in it. Serological experiments showed that the sap from scions of *L. barbarum* grafted for two months on mosaic tobacco stocks contained no antibodies, the presence of which would have been reflected in a heightened precipitin content. When the leaves of healthy *N. glutinosa* plants are rubbed, before inoculation with the mosaic virus, with anti-virus serum (obtained from inoculated animals), the number of necroses is considerably reduced, a similar but less pronounced effect following the application of serum after inoculation. This phenomenon, however, appears to be attributable rather to the protective action of serum in general than to any specific property of the anti-virus serum, since it was impossible to induce passive immunization of healthy tobacco plants by inoculation with a mixture of the virus and serum. Negative results were also given by attempts at the active immunization of tobacco plants by inoculation with dilute solutions of the virus.

When mixtures of virus and anti-virus serum were prepared in test tubes, the supernatant liquid above the precipitate was not virulent unless the mixture contained an excess of virus. In mixtures of the mosaic virus and active anti-virus serum even the precipitate loses its virulence partly or wholly. The behaviour of the anti-virus serum towards the expressed sap of mosaic plants *in vitro* is considered to support the conception of the organic nature of the infective principle [cf. ibid., xi, p. 734 *et passim*].

WILLE (F.). **Puffergrösse und Auftreten von Pflanzenkrankheiten.** [Buffer content and occurrence of plant diseases.]—*Zentralbl. für Bakt.*, Ab. 2, lxxxvii, 13–16, pp. 301–331, 1933.

This is an expanded account of the writer's studies in Valais, Switzerland, on the part played by the buffer content in determining the reaction of certain vines, conifers, and deciduous trees, to various fungous diseases, as well as to smoke and gas injury, a preliminary note on which has already appeared [*R.A.M.*, ix, p. 48]. The parasitic fungi mentioned are *Plasmopara* [*viticola*] and *Pseudopeziza* [*tracheiphila*] on the vines, *Lophodermium* and *Hypodermella* on the conifers [ibid., xii, p. 254], *Gnomonia erythrostoma* and *Clasterosporium carpophilum* on *Prunus avium*, and *C. carpophilum* and *Polystigma rubrum* on *P. domestica* [ibid., xi, p. 660].

SCHAFFNIT (E.) & LÜDTKE (M.). **Über die Bildung von Toxinen durch verschiedene Pflanzenparasiten.** [On the formation of toxins by various plant parasites.]—*Ber. Deutsch. Bot. Gesellsch.*, l, 9, pp. 444–463, 2 figs., 1932.

An account is given of the writers' investigations on the

chemical nature and effects of the toxins secreted by *Ophiobolus graminis*, *Fusarium vasinfectum*, *F. lycopersici*, and *Didymella lycopersici*.

The germination of wheat seed-grain was arrested or prevented by the toxins secreted by cultures of *O. graminis* on mixed wheat, barley, and oat grain. The toxic principle in the filtrate was not inactivated by distillation in an oil bath in which the temperature rose to 125° C. Germination tests showed that the toxins scarcely pass into the distillate, the adverse effect on growth being practically confined to the residue. The filtrate of the fungus on a medium of ground wheat grain produced no toxic effect on germination even after 4½ months. Wilting was produced in cut tomato shoots placed in an aqueous extract of mixed grain on which *O. graminis* had grown as indicated above, but not in one of ground wheat.

Cotton and tomato plants were injured or killed by the filtrates of cultures of *F. vasinfectum* and *F. lycopersici*, respectively, on Richards's solution, the optimum temperature for the development of the former on which was found to be 24° to 28° C. Wilting of cotton began after 28 hours in the filtrate of a week-old culture of *F. vasinfectum*, the corresponding period for tomato in the *F. lycopersici* filtrate being 24 hours; at and after five weeks old the culture filtrates were capable of destroying the plants in a few hours (seven at the most). The $P_H$ value of the culture fluid at five weeks had risen from an initial of 4·02 to 7·41 in the case of *F. vasinfectum* and to 7·84 in that of *F. lycopersici*. The toxic principle, as in the case of *O. graminis*, was found to be virtually restricted to the residue on distillation. Lathrop's assumption that the presence in the filtrate of propionaldehyde is the cause of wilting (*Phytopath.*, vii, p. 14, 1917) could not be verified by the writers.

A strongly toxic action was exerted on the test plants by the extract from centrifuged ground hyphae of *F. vasinfectum*, indicating that the poison is an organic substance residing in and excreted by the fungus, and not a product of the nitrites or other salts of the culture liquid, as suggested by H. R. Rosen [*R.A.M.*, xi, p. 513]. Not only cut tomato plants but those with intact roots, contrary to Bewley's observations [ibid., ii, p. 149], were wilted by a 0·5 per cent. solution of the toxin, which lost none of its virulence by 20 minutes' boiling. In all probability the toxic substance is an amine or combination of amines. Both the culture filtrate and the mycelial extract of *F. vasinfectum* caused wilting of clover, peas, chrysanthemum, cotton, beans [*Phaseolus vulgaris*], and wheat in addition to tomato. Cotton, pea, and wheat seeds laid (after sterilization and washing) between sheets of blotting-paper moistened with the toxic solution suffered retardation of germination. The diaminoacids, e.g., d-lysin and d-arginin, in 0·5 per cent. solutions, were found to cause severe wilting of tomato plants in 48 hours, while the same concentration of asparagin, colamin, diethylamin, and allylamin (especially the last-named) reduced the germination of wheat.

Cut tomato plants were severely wilted by a 2·5 per cent. solution of the residue from the culture filtrate of *D. lycopersici* after

treatment with methyl alcohol [ibid., xi, p. 809], as well as by the mycelial extract, but not by the distillate. Here again the toxic principle evidently resides in the organism itself, presumably in the form of amines or amino acids. *F. vasinfectum*, *F. lycopersici*, and *D. lycopersici* differ in this respect from *O. graminis*, the toxins developing during the growth of which in culture appear to be the metabolic products of the nitrogenous elements in the medium, rather than substances in the fungus itself.

HANSEN (H. N.) & SMITH (R. E.). **The mechanism of variation in imperfect fungi: Botrytis cinerea.**—*Phytopath.*, xxii, 12, pp. 953–964, 3 figs., 1 diag., 1932.

This is an expanded account of the writers' studies on the mechanism of variation in single-spore isolations of 47 cultures of *Botrytis cinerea* collected from different plants in California, a brief note on which has already appeared [*R.A.M.*, xi, p. 477]. It is stated that while the perfect stage of any of the fungi referred to *B. cinerea* does not seem to have been recorded in America, Whetzel has informed the authors that he has confirmed the connexion between the European grape *Botrytis* and *Sclerotinia fuckeliana* [ibid., viii, p. 607].

The hyphal cells and conidia of the fungus were found to be multinucleate, and hyphal anastomosis is very common. It is suggested that by the mechanism of anastomosis nuclei of one strain may migrate into the cells of other strains, thereby giving rise to cells and spores containing two or more kinds of genetically different nuclei. On the assumption that the basic unit of the individual is the nucleus and not the cell, it is further suggested that a multinuclear spore is not an individual but a colony, which cannot produce a genetically pure culture unless all its nuclei are genetically identical.

It is suggested that variable forms of the Fungi Imperfecti may owe their instability, not to mutation, but to nuclear heterogeneity (heterocaryosis), a condition that may be induced both *in vivo* and *in vitro* by the nuclei of one strain entering the cells of another strain through anastomoses.

BAILEY (ALICE A.). **Effects of ultraviolet radiation upon representative species of Fusarium.**—*Bot. Gaz.*, xliv, 2, pp. 225–271, 1 pl., 4 figs., 2 graphs, 1932.

A comprehensive and fully tabulated account is given of the author's comparative study of the effects of irradiation (mostly with a Cooper-Hewitt quartz mercury-arc lamp, operated on alternating current at 4 amperes through resistance from a 110-volt line) on sporulation and certain physiological attributes, e.g., colour production and growth rate, in representative species of *Fusarium* [*R.A.M.*, ix, p. 400].

In most of the 59 species, varieties, and forms exposed to the ultra-violet rays through filters transmitting waves as low as 2,650 but not lower than 2,300 Ångström units there was an increase in total sporulation, sometimes accompanied by pigmentation in the mycelium. A very marked increase in macrospore

percentage followed three daily 15-minute treatments under vita-glass (transmitting to 2,650 Ångström units) in *F. neoceras*, *F. cepae* [ibid., xii, p. 135], *F. solani* var. *medium*, *F. sporotrichioides*, *F. vasinfectum* var. *zonatum* and forms 1 and 2, *F. bulbigenum* [ibid., x, p. 795], and *F. redolens* [ibid., viii, p. 520]. On the other hand, *F. conglutinans*, *F. bulbigenum* form 1, *F. moniliforme* (*Gibberella moniliformis*) and its varieties, *F. orthoceras*, *F. oxysporum*, and others showed little or no increase of sporulation as a result of irradiation. All the species responding to the treatment, except *F. oxysporum* var. *nicotianae* (the pathogenicity of which was not tested), were saprophytes or decay producers, the vascular parasites giving no appreciable reaction to the rays.

In *F. culmorum* the treated plates showed up to 83 per cent. macrospores at a time when they were completely absent from the controls; this increase was maintained even after the latter began to sporulate. Conidial production was further stimulated by irradiation in a strain of *F. coeruleum* that had not hitherto sporulated, as well as one of *F. sambucinum* [ibid., vi, p. 624], the activity of which was in abeyance. One strain of *Fusarium* (section *Gibbosum*) from decayed onion bulbs, that had never sporulated in the laboratory, produced 75 per cent. macrospores under irradiation.

*F. vasinfectum* var. *zonatum* and *F. semitectum* [ibid., xii, p. 39] yielded the maximum amount of macrospores under Corex filter 980 A, transmitting to 2,300 Ångström units, the corresponding peak with *F. sporotrichioides* and *F. bulbigenum* occurring under Corex 986 A between 2,535 and 4,340 Ångström units. A distance of 40 cm. from the arc proved best for the purposes of these tests. Direct exposure at 2,230 Ångström units resulted in a decreased growth rate and other injurious effects varying according to the species. *F. argillaceum* usually produced many chlamydospores on irradiation. In some species, e.g., *F. vasinfectum* var. *zonatum*, the macrospore content reached a peak 48 hours after the cessation of irradiation, whereas in others, *F. bulbigenum* for instance, the maximum occurred 24 hours after the third exposure.

None of the 14 species of *Fusarium* with known perfect stages used in the experiments produced perithecia on irradiation except two plates of *F. javanicum* [ibid., xii, p. 197] var. *theobromae*.

SCHMIDT (E. W.). **Über eine pathologische Fettbildung in Zuckerrübenblatt.** [On a pathological fat formation in the Sugar Beet leaf.]—*Ber. Deutsch. Bot. Gesellsch.*, 1, 9, pp. 472–474, 1 fig., 1932.

Attention is drawn to the formation, in the cells of sugar beet leaves infected by *Uromyces betae* [*R.A.M.*, xi, p. 91], of accumulations of fat drops round the uredosori. The phenomenon may be conveniently studied in sections stained with Sudan red and treated with sulphuric acid, and its occurrence may be regarded as diagnostic of beet rust. There were indications of a similar aggregation of fat drops in wheat leaves artificially inoculated with *Puccinia glumarum*.

CRAIGIE (J. H.). **Union of pycniospores and haploid hyphae in Puccinia helianthi Schw.**—*Nature*, cxxxi, 3297, p. 25, 1 fig., 1933.

The examination of freehand sections of monosporidial pustules of *Puccinia graminis* and *P. helianthi* [*R.A.M.*, xii, p. 235] usually revealed two types of hyphae protruding through the pycnidial ostioles, viz., (1) the ordinary stiff, tapering, slightly curved paraphyses, and (2) flexuous hyphae showing considerable variations in dimensions, shape, and other features. In some of the pycnidia (probably the older ones) of a pustule, these hyphae may be profusely developed, whereas in others they are almost or entirely absent. They are generally as long as the paraphyses, sometimes two or three times as long, and seldom shorter. Branching may occur but septation is rare. Some of the flexuous hyphae have swollen tips, from the side of which a short spur or peg occasionally protrudes. The latter is believed to act as a means of contact between a hypha of one sex and a pycnospore of the opposite sex, several cases of fusion between which were observed in sections of haploid pustules of *P. helianthi* with the nectar so intermixed that both (+) and (−) pycnospores were present on the surface of each pustule and in close proximity to the protruding hyphae. Empty pycnospores found connected by short tubes to these hyphae furnish strong circumstantial evidence that nuclei migrate to them from pycnospores by means of fusion tubes. This type of union simulates that between oidium and hypha in the Hymenomycetes [cf. ibid., xii, p. 186].

VAN DER MEER (JIKKE H. H.). **A study of the virus from the apparently healthy Potato variety 'Green Mountain'.**—*Zentralbl. für Bakt.*, Ab. 2, lxxxvii, 9–12, pp. 240–262, 11 figs., 1932.

The writer's greenhouse experiments at Wageningen, Holland, in 1930 and 1931, showed that the apparently healthy Green Mountain potato variety is the carrier of a virus producing pathological symptoms varying according to the host and the stage of development of the foliage [cf. *R.A.M.*, xii, p. 48].

Two chilli (*Capsicum annuum*) varieties reacted to inoculation with Green Mountain leaf or tuber juice by necrosis, which in some cases resembled the top necrosis or acronecrosis produced when Paul Kruger [President] potatoes were grafted with apparently healthy Green Mountain by Quanjer and Botjes [ibid., ix, p. 482; x, p. 746]; *Datura stramonium*, tomato, tobacco, and *Hyoscyamus niger* reacted by distinct mosaic; and *Physalis alkekengi* and *Solanum nodiflorum* by mild mosaic [ibid., v, p. 119]. No symptoms developed in inoculated plants of *S. dulcamara*, *S. capsicastrum*, *Atropa belladonna*, and *Cyphomandra betacea*.

The oldest reacting leaves of *D. stramonium*, tomato, tobacco, and *H. niger* were characterized by clearing of the veins, the younger by veinbanding, the later developing foliage of *D. stramonium*, tomato, and *H. niger* by irregular yellow areas, and that of tobacco by ring spot. The older leaves showed these symptoms at the base and the younger towards the tip. Once established, the symptoms were irreversible. The passage of water in diseased *D.*

*stramonium* plants was found to be slower and less regular than in normal ones.

*D. stramonium* serves as a useful indicator in experiments with the Green Mountain virus, to which it reacts rapidly and distinctly. The various symptoms manifested by this host, viz., clearing of the veins, veinbanding, and yellow areas, were all found to be due to the same virus. At least three days are requisite for the transference of the virus from the infected leaf to the stem. The viability of the virus *in vitro* is at least 18 days. It is inactivated by ten minutes' heating of the juice at 75° C. and by admixture with 64 per cent. alcohol (but not with 50 per cent.). The incubation period is protracted by dilution of the juice, a noticeable delay occurring after a dilution of 1 to 100; only one out of twelve plants became diseased on inoculation with the virus diluted 1 to 100,000, and the incubation period was doubled.

In many respects the Green Mountain virus agrees with Johnson's virus 5, which produces ring spot on tobacco, but apparently no symptoms on potato [ibid., vi, p. 501], though it does not seem to be quite identical, especially in its more severe effects on *Capsicum*.

Tuber inoculations on President showed that a number of other potato varieties carry the same virus as Green Mountain, e.g., Magdeburger Blaue, Irish Cobbler, Rural, Kerr's Pink, Preussen, Eersteling [Duke of York], Jubel, Juli, and Arran Comrade. *D. stramonium* developed symptoms similar to those described above on inoculation with the juice of these varieties. The symptoms produced on President potatoes sometimes left a doubt as to whether the virus concerned was that of acronecrosis or acropetal necrosis [ibid., x, p. 746], but in such cases inoculations on *D. stramonium* gave conclusive indications.

GIGANTE (R.). **Risultati di un' esperienza sull'ereditarietà della maculatura interna dei tuberi di Patata.** [Results of an experiment on the hereditary nature of internal spotting of Potato tubers.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 3, pp. 275–277, 2 figs., 1932.

When potato tubers showing an internal, irregular, reddish-brown spotting resembling the hereditary type of 'Eisenfleckigkeit' [*R.A.M.*, ix, p. 199; xi, p. 199] were planted, the resultant plants appeared normal but the tubers showed the same condition. The yield from the originally affected tubers was only one quarter to one half that of the healthy controls, and 20 to 70 per cent. of the tubers from each plant were affected. The condition is considered to be a virus disease due to the pseudo-net necrosis virus of Quanjer, transmitted by *Myzus persicae* [*R.A.M.*, ix, p. 483; x, p. 746].

EGLĪTS (M.). **Der Einfluss der Infektion auf die Temperatur und die Kohlensäureabgabe bei Kartoffeln.** [The influence of infection on temperature and the emission of carbonic acid in Potatoes.]—*Phytopath. Zeitschr.*, v, 4, pp. 343–379, 18 diags., 15 graphs, 1932.

Full details are given of an apparatus for the measurement of temperature variations and of the production of carbonic acid in

potato tubers infected by blackleg (*Bacillus phytophthorus*). The temperature variations are electrometrically determined and the production of carbonic acid measured by titration. The experiments were carried out on whole and bisected tubers of the Kaiserkrone and Fischli varieties.

Infection by *B. phytophthorus* was found to cause appreciable rises in temperature, accompanied by an enhanced production of carbonic acid, extending through all the tissues of the diseased tuber, though most marked at the site of invasion. Both the rise in temperature and the increased production of carbonic acid in diseased plants reached a climax after varying periods, succeeded by a decline affecting all the tissues. The maximum temperature was attained in whole tubers in 50 to 75 hours, the corresponding period for bisected ones being 55 to 100. Carbonic acid production reached a maximum after 60 to 160 hours in different tests, the increase over the normal for healthy tubers ranging from 467 to 1,063 per cent.

Although no conclusive results can be drawn from these experiments, it would seem that the phenomena under discussion are connected with the secretion by the parasite of metabolic products or toxins, the action of which on the host tissue is analogous to that of narcotics [cf. *R.A.M.*, xii, p. 45]. The small quantities of these substances released in the early stages of infection stimulate the production of carbonic acid, a process that is subsequently arrested by the increasing amounts of toxins liberated with progressive invasion of the tissues.

MAGEE (C. J.). **The occurrence of blackleg of Potatoes in New South Wales.**—*Agric. Gaz. New South Wales*, xliii, 12, p. 886, 1932.

The author states that in 1932 he definitely established the occurrence of potato blackleg [*R.A.M.*, xi, p. 258] in New South Wales, where in the spring the disease occasioned heavy losses in many potato crops in the coastal areas. It is pointed out that the author's isolations of the bacteria causing the disease [*Bacillus phytophthorus*] did not agree in cultural characters with an organism isolated by Waterhouse in 1931 from a suspected blackleg plant, but it is thought possible that the latter may come within the group recorded in other parts of the world as blackleg pathogens [loc. cit.].

SIBILIA (C.). **Esperienze di lotta contro la scabbia delle Patate.** [Experiments in the control of Potato scab.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 3, pp. 298–305, 1932.

In field tests near Naples, using the highly susceptible Böhm's Allerfrüheste Gelbe variety showing 100 per cent. scab (*Actinomyces scabies*) [*R.A.M.*, xi, p. 533; xii, p. 189], 26 per cent. of the tubers in the control plot (given only the usual fertilizer) became scabby. In the plot given stable manure 27·5 per cent. of the tubers were scabbed. When the seed pieces were disinfected with sulphur there were 14·5 per cent. infected tubers, this figure falling to 9·5 per cent. when Caffaro powder [ibid., i, p. 66 *et passim*] was used. When slaked lime was added to the soil at the rate of 10

quintals per hect., the tubers themselves being untreated, only 11 per cent. infection resulted, the addition of gypsum and sulphur giving, respectively, 19 and 21 per cent. infection. The corresponding figures for parallel plots in another locality were 18, 30, 16, 10, 7, 14, and 18 per cent. Pointing out that the beneficial effect of the slaked lime confirms the result recently obtained by Schlumberger with quicklime [ibid., xi, p. 321], the author states that in one of the localities where scab is prevalent the soil contained only 1 per cent. calcium carbonate though its $P_H$ value was 8·3.

When a grower planted (on soil not previously sown to potatoes for four years) a plot of the same variety, all seriously scabbed, about 18 per cent. infection resulted. In another test some control was given by dusting the seed pieces with a proprietary powder with a mercury base 'unidea'.

A very prevalent condition, consisting in an abundant development of corky flakes on the tubers, generally attributed to the nature of the soil or drought, was noted during a wet season in one locality where the soil is very light and copious irrigation is practised; the author considers that it is definitely a disease, probably of the virus group.

Moreau (F. v.). **Schorf und Stippigkeit bei Kartoffeln.** [Scab and internal rust spot of Potatoes.]—*Deutsche Landw. Presse*, lix, 50, p. 630, 1932.

So far the sole reliable means of combating potato scab [*Actinomyces scabies*: see preceding abstract] in Germany appears to be the cultivation of resistant varieties, such as Hindenburg, Jubel, and Ackersegen.

As regards [non-hereditary] internal rust spot ('Eisenfleckigkeit') [*R.A.M.*, xii, p. 289], the disease may occur equally on heavy, impermeable and excessively light soils with a tendency to incrustation, the fundamental cause in both cases being a disturbance of respiration.

Rang. **Schorf und Stippigkeit bei Kartoffeln.** [Scab and internal rust spot of Potatoes.]—*Deutsche Landw. Presse*, lix, 52, p. 653, 1932.

Commenting on v. Moreau's explanation of the causation of 'Eisenfleckigkeit' (internal rust spot) of potatoes [see preceding abstract], the writer adheres to his opinion that the primary factor in its development is the use of fresh pig manure. Under Oldenburg conditions it has been found inadvisable to employ the latter except as an admixture in other kinds of manure. No doubt disturbances of growth due to excessive rain and consequent stagnation in impermeable soils also play an important part in the occurrence of internal rust spot.

Straňák (F.). **Přehled odrůd Bramborů, které podle tříletých zkoušek ve Šluknově v letech 1921–32 zjištěny imunními vůči rakovině bramborů.** [List of Potato varieties which were ascertained to be immune from Potato wart disease in the three years' tests made at Šluknov from 1921 to 1932.]—*Ochrana Rostlin*, xii, 5–6, pp. 97–100, 1932.

This is a list of 50 [named] varieties of potato which showed

complete resistance to the potato wart disease (*Synchytrium endobioticum*) in the three years' field tests which have been conducted at Šluknov (Czecho-Slovakia) from 1921 to 1932 [cf. *R.A.M.*, x, p. 125]. It is pointed out that in these tests special attention was paid to yellow-fleshed, comestible varieties, most suited for cultivation by small-holders in industrial areas.

Říha (J.). **O volbě vhodných imunních odrůd Bramborů v uzavřených oblastech.** [On the choice of immune Potato varieties in quarantined areas.]—*Ochrana Rostlin*, xii, 5–6, pp. 134–138, 1932.

In this paper an annotated list is given of a number of potato varieties (chiefly for table consumption) immune from potato wart disease [*Synchytrium endobioticum*: see preceding abstract] which are recommended for cultivation in quarantined areas (within a radius of 15 km. from an infected centre) in Czecho-Slovakia. Among other information the notes also include indications of the suitability of the varieties for different types of soil and other ecological factors.

Dix & Kühlmorgen. **Untersuchungen über die Keimung der Dauersporangien von 'Synchytrium endobioticum'.** [Investigations on the germination of the resting sporangia of *Synchytrium endobioticum*.]—*Pflanzenbau, Pflanzenschutz u. Pflanzenzucht*, ix, 6, pp. 209–216, 1932.

Experiments were carried out at the Agricultural Institute of Kiel University to determine the best method of germinating the sporangia of *Synchytrium endobioticum*, the agent of potato wart disease [*R.A.M.*, xi, p. 321 *et passim*]. The sporangia used in the tests were taken direct from infected potatoes. The most satisfactory results in preliminary trials were obtained by the use of boiled expressed potato juice (100 gm. tuber to 1,000 c.c. water) + 0·01 per cent. solanin, which gave 18 per cent. germination after two days and 58 per cent. after three months, as against 3 and 30 per cent., respectively, in tap water and 13 and 46 in boiled expressed juice alone. No very marked differences were observed between the effects on sporangial germination of the extracts of a resistant (Preussen) as compared with a susceptible ('5/6') variety. The highest percentage of germination after four months in this series (82) was obtained in a 6 per cent. solution of expressed leaf juice of the resistant variety.

It was shown that the addition of certain supplementary substances (solanin, diastase, and malic acid) to the water cultures curtailed the germination period of the sporangia to some extent, but only in the case of such individuals as would normally reach maturity in four to five months. There is always a certain proportion of sporangia (some 5 per cent. a month in these tests) ready to germinate under appropriate conditions, so that in about two years all would presumably have germinated. The supplementary substances only accelerate the initial processes of germination, after which their effect completely ceases, and it appears probable from the foregoing experiments that in six months' time all the cultures would show similar germination percentages.

[NATTRASS (R. M.).] **The wilt disease of Potatoes.**—*Cyprus Agric. Journ.*, xxvii, 4, pp. 138–139, 1932.

In 1932 the wilt disease of potatoes associated with *Fusarium* and *Rhizoctonia* spp. developed comparatively late in Cyprus, in contrast to 1931 when it caused heavy and widespread damage during August, September, and early October [*R.A.M.*, xi, p. 695]. Apparently healthy plants suddenly droop as though severed from the base and rapidly die. The haulms are usually darkened near the collar, at which point the stem later decays, while a brown discoloration of the xylem extends for some distance up the stem. Both the fungi involved inhabit the soil and probably enter the stems through epidermal cracks due to over-watering. Infection may pass from the haulm to the tubers which, if planted, will produce a diseased crop. Control measures are briefly indicated.

BEELEY (F.). **Effect of meteorological factors on the virulence of Oidium heveae in Malaya.**—*Journ. Rubber Res. Inst. Malaya*, iv, 2, pp. 104–114, 4 graphs, 1932.

Though *Oidium heveae* is prevalent in Malaya [*R.A.M.*, xi, p. 744], no real epidemic of leaf fall of rubber due to it has yet occurred. Some districts have suffered moderately, but control measures have not been required and the trees have shown no reduction in yield or vigour. In Ceylon, Java, and Sumatra the areas severely attacked are all at altitudes over 1,000 ft., but in Malaya no rubber is grown at altitudes over 400 ft.

In a cold chamber with a temperature varying between 56° and 62° F. and relative humidity (the vapour pressure represented as a percentage of the maximum possible at the given temperature) between 75 and 80·6 per cent., the fungus made excellent growth on the host, spreading rapidly over rubber leaves and flowers and producing chains of 3 to 7 spores. At room temperature, 72° to 92°, with humidity varying between 50 and 93 per cent., medium growth took place, with the production of chains of 2 or 3 spores. At temperatures between 45° and 50° (humidity between 73·6 and 78 per cent.) the mycelium at first spread well over the leaf surfaces, but very few conidiophores were produced and each bore only one spore. For optimum growth, spore production, and spore germination *O. heveae* requires a temperature between 56° and 62°, a relative humidity between 75 and 80 per cent., and suitable living tissue on which to grow. The fungus grew best on fresh young rubber leaves two or three inches long.

In the Malay States the temperature is always above the maximum limit for the optimum growth of the fungus, while the humidity favours its optimum activity for only about one hour in the morning and less than two hours in the afternoon.

BEELEY (F.). **Report on sulphur dusting experiments.**—*Journ. Rubber Res. Inst. Malaya*, iv, 2, pp. 115–122, 1 pl., 1932.

Dusting tests carried out in Malaya against *Oidium heveae* (using a Björklund machine) showed that flotate sulphur [*R.A.M.*, xi, pp. 672, 802] containing over 90 per cent. pure sulphur had better physical properties than mud sulphur containing 70 per cent. pure sulphur, in that it was drier, formed a denser cloud

which remained suspended over the trees for two or three minutes, and contained less granular matter. Between the 2nd and 18th March rain fell on nine days, twice interfering with the dusting. The experiment was stopped when some 1,200 acres had been dusted. From 250 to 300 acres were easily dusted in an 8-hour day, so that working once a week one machine should dust 2,100 acres per season. The total cost per acre, for five weekly applications each of 10 lb. flotate sulphur amounted to $3·36 [= 7*s.* 10*d.*]. It appears that 7 to 10 lb. of sulphur per acre per application are necessary to maintain a prophylactic effect for ten days.

Conn (H. J.). **The Cholodny technic for the microscopic study of the soil microflora.**—*Zentralbl. für Bakt.*, Ab. 2, lxxxvii, 9–12, pp. 233–239, 4 figs., 1932.

Attention is drawn to the great value of Cholodny's technique for the microscopic study of soil micro-organisms [*R.A.M.*, xi, p. 802], an important feature of which is its capacity for indicating a change in the predominating flora from fungi to actinomycetes or bacteria and vice versa. The method consists essentially in pressing a microscope slide against the side of a narrow trench cut in the soil and leaving it in position for about two weeks so that the soil organisms grow over the adhering surface, then removing and staining for examination. The author prefers to place the soil to be examined in a tumbler and insert two slides which can be left for different periods, one being removed usually after 5 to 7 days.

Todd (Ramona L.). **Phycomycetes, Ascomycetes, and Fungi Imperfecti in Oklahoma soil.**—*Science*, N.S., lxxvi, 1977, p. 464, 1932.

Samples of soils in Cleveland County, Oklahoma, were taken at four different depths, viz., 2, 8, 20, and 40 cm. below the surface, the average numbers of fungi at each depth being 313,000, 423,000, 134,000, and 195,000 per gm., respectively [cf. *R.A.M.*, xi, p. 264]. *Aspergillus niger* was very extensively represented, constituting 43·7 per cent. of the fungi at 2 cm., 38·9 at 8, 26·6 at 20, and 25·2 at 40. Possibly the strictly aerobic character of this organism may account for its decline at the lower depths.

Jensen (H. L.). **Contributions to our knowledge of the Actinomycetales. IV. The identity of certain species of Mycobacterium and Proactinomyces.**—*Proc. Linn. Soc. New South Wales*, lvii, 5–6, pp. 364–376, 4 figs., 1932.

In the fourth paper of this series [*R.A.M.*, xii, p. 241] the author deals with seven organisms previously described as species of *Mycobacterium* but which, on account of their mycelial growth in the initial stages of their life-cycles, were found to belong to his recently established genus *Proactinomyces* [ibid., xi, p. 602]. One of these, *P. corallinus*, was isolated from Australian soils, the others being obtained from Europe for comparison. The species of this genus so far examined form two groups, the first of which includes non-proteolytic and partially acid-fast, and the second

mostly proteolytic and non-acid-fast organisms. From the latter group there is a clearly marked transition to *Actinomyces*.

Jones (W.). **The downy mildew of the Hop in British Columbia.**—*Journ. Inst. of Brewing*, N.S., xxx, 3, pp. 126–127, 1933.

Experiments conducted at Saanichton, British Columbia, indicated that the infection of hop seedlings by downy mildew [*Pseudoperonospora humuli*: *R.A.M.*, xi, p. 602] occurs at or below soil level, the fungus first attacking the cotyledons and then becoming systemic in the plant. Initial infection is probably caused from oospores which occur abundantly in the bracts of diseased cones, though there is a possibility that it comes from hibernating mycelium within the seed. Seedling infection is of practical importance to growers, since cultivation is frequently neglected in the early spring owing to the heavy rainfall, with the result that diseased seedlings come up and produce large crops of conidia under particularly favourable conditions.

Satisfactory results have been obtained in preliminary experiments in the Fraser Valley by dusting the young crown shoots in the spring with Bordeaux dust (16 lb. copper sulphate to 100 lb. calcium hydroxide), infection in one garden being reduced from 31 per cent. in the untreated part to 4·6 and 0·3 per cent., respectively, in two dusted sections. The development of basal spikes was adequately held in check by this means. The cost of dusting the crowns is negligible in comparison with spraying. The mixture was applied at the rate of 50 lb. per acre, and one person was able to dust 8 acres a day. The approximate cost of materials and treatment was $ 1·25 per acre.

**Control of Hop downy mildew by dusting.**—*Brewers' Journ.*, lxix, 811, p. 51, 1933.

On the whole, the results of experiments in Canada and the United States in the control of hop downy mildew [*Pseudoperonospora humuli*: see preceding abstract] by dusting with copper sulphate and lime between 1928 and 1931 were sufficiently encouraging to justify further trials, which were conducted in 1932 by G. R. Hoerner of the United States Department of Agriculture.

Copodust, a proprietary material consisting of 1 part monohydrated copper sulphate and 4 of lime [*R.A.M.*, ix, pp. 266, 358] was applied in excess during the early morning. For the first application hand dusters were used, while the second and third treatments were applied with a power duster.

By 24th May, when stringing was completed, infection was general. The first dust was applied on the 25th, and an examination between 9th and 14th June showed heavy infection, both in the dusted and the control plots, though the former showed a higher proportion of healthy plants. The second application was begun on 30th June and completed on 12th July, and here again there was no striking difference as regards downy mildew between the treated and untreated plots. No recent infection was apparent and very few spikes were in evidence. Slight burning of the

leaves and flowers by the copper was apparent. The final dustings were made on 9th and 12th August, an excellent covering (as in the second application) being obtained, with no burning. The increased yield due to dusting, however, was insufficient to justify the expense of the treatment, which may nevertheless be a valuable adjunct to spraying, especially during wet periods late in the season when it is necessary to cover large areas in a short time.

BLATTNÝ (C.). **Poznámky o Peronospoře Chmelové (Pseudoperonospora humuli Miyb. et Tak.).** [Notes on the *Peronospora* of Hops (*Pseudoperonospora humuli* Miyabe et Tak.).]—*Ochrana Rostlin*, xii, 5–6, pp. 139–144, 1 graph, 1932. [German summary.]

A survey of the main climatological factors in Czecho-Slovakia during the three years 1930 to 1932 shows that in that country serious outbreaks of downy mildew (*Pseudoperonospora humuli*) of hops occur only in abnormally wet seasons, when there are over 59 rainy days between the beginning of May and the end of September, with intervals of not more than 5 or 6 dry days between the wet periods. It is only during such years that the disease requires control by spraying.

Artificial inoculation experiments with summer spores on first year selfed seedlings of the variety Semšûm červeňák indicated that the seedlings did not differ from the parent plants in their susceptibility to *P. humuli*. Terminal and lateral spikes were formed on the seedlings [cf. *R.A.M.*, xii, p. 111]. This demonstrates that tests of the resistance of new varieties may be successfully made on seedlings in their first year of growth, thus shortening the test trials as practised hitherto by a whole year.

RICHARDSON (P.). **Cane varieties in Puerto Rico.**—*Facts about Sugar*, xxvii, 12, pp. 530–532, 2 diags., 1 map, 1932.

Mosaic is stated to be the only sugar-cane disease of real economic importance in Porto Rico, where a record crop was produced in 1932, and its control presents virtually no difficulty, except in the west and north-west of the island where the P.O.J. 36 and 313 varieties are still grown, and in the Manati Valley and central-eastern regions in which B.H. 10 (12) and S.C. 12 (4) are largely cultivated. The infected areas are gradually diminishing owing to the extended use of P.O.J. 2725 and 2878, as well as the varieties bred by the Insular Experiment Station, which are not only immune from mosaic but excellent yielders [*R.A.M.*, xii, p. 113].

Gummosis [*Bacterium vascularum*: ibid., xi, p. 542] exists only on the island of Vieques, where there are some 4,000 acres of the susceptible Cristalina and Rayada varieties under cultivation, while pokkah-boeng [*Gibberella moniliformis*: ibid., xi, p. 403] is uniformly present in a mild form on P.O.J. 2725 and 2878.

A map shows the distribution of cane varieties in the different parts of Porto Rico in 1932.

DODDS (H. H.). **The origin of mosaic disease.**—*South African Sugar Journ.*, xvi, 11, pp. 617, 619, 1932.

The following information is extracted from a report prepared

by the author on the sugar industry of Porto Rico, based on observations made and data collected during his visit to the island in March, 1932, as a delegate to the International Congress of Sugar Technologists (p. 609). Mosaic originated in the North Coast hills of Porto Rico in 1915 and spread rapidly until the establishment of the Uba cane, which was found to be immune in 1918 and distributed for general cultivation in 1924. In that year the yield per acre in the Pagan district amounted to 29·84 tons compared with 16·24 in 1917 (before mosaic) and 12·40 in 1921, when the disease was severe. In San German the yields in 1917, 1922, and 1924 were 17·78, 10·08, and 24·51 tons per acre, respectively, while in Eureka the production rose from 8 tons per acre in 1921 to 20·22 in 1924. The disease is no longer regarded as a serious factor in the Porto Rican sugar-cane industry, owing to the extensive cultivation of superior resistant varieties, e.g., P.O.J. 2725 and 2728, and new seedlings [see preceding abstract].

KOPP (A.) & D'EMMEREZ DE CHARMOY (D.). **Situation actuelle de la mosaïque de la Canne à la Réunion.** [The present Sugar-Cane mosaic situation in Réunion.]—*Stat. Agron. Réunion, Travaux Techniques*, Bull. 3, pp. 11–19, 1932.

Mosaic of sugar-cane is now prevalent throughout all the leeward region of Réunion [see next abstract]. There are three main centres of infection, near one of which, however, only slight attacks are experienced owing to the large-scale planting of the completely immune variety Richfund No. 1, a first generation hybrid of a cross between true Uba and D. 109. No correlation was established between intensity of attack or varietal susceptibility and the altitude of the plantation. Louzier, Port Mackay, Mapon, and M. 131 are classed as highly susceptible, Batavia (Guinghan), D. 74, Isautier, and M. 55 as showing average infection, Big White Tanna and Naz as showing relatively slight infection, P.O.J. 213 and 36 as very slightly affected (relatively tolerant), and Uba, Uba Seedling blanche, Uba Marat, Richfund No. 1, and Uba No. 4 as completely resistant. The P.O.J. canes 2878, 2725, 2714 and the Co. canes 214, 290, and 281 have not yet shown mosaic. In the badly affected areas the only possibility of control consists in complete replacement of the diseased varieties.

KOPP (A.) & D'EMMEREZ DE CHARMOY (D.). **Observations nouvelles concernant la mosaïque de la Canne à Sucre et le streak du Maïs.** [New observations of mosaic of Sugar-Cane and streak of Maize.]—*Stat. Agron. Réunion, Travaux Techniques, Bull.* 3, pp. 1–10, 3 figs. [facing p. 12], 1932.

In the leeward part of Réunion where mosaic of sugar-cane is present [*R.A.M.*, x, p. 490] all the Noble varieties are affected, Louzier and Port Mackay have almost disappeared under the combined attack of mosaic and gummosis [*Bacterium vascularum*], and M. 131 (Black Innis) and Batavia (Guinghan) are violently attacked and become progressively less resistant every year. The windward side of the island is relatively free from the disease except in one locality.

A similar instance of prolonged incubation to that already

reported [ibid., x, p. 490] occurred on a P.O.J. 2725 × Uba Marot seedling. In January and February, 1931, i.e., seventeen months after the last of the previously reported infections, all the canes grown in the Agricultural Station collection as original stock were cut down and removed to another locality, the stumps being left; in December, 1931, the original stool of Guinghan × D. 74 and three others of the same parentage became affected. This, it is considered, implied an exceptionally long incubation period, latency, or reinfection from an apparently healthy cane. In the locality to which the canes were removed, ten months after planting and seventeen months after the last case of mosaic had been seen in the original locality, a stool of A. 12/29 seedling and one of A. 166/29 (both from Guinghan × D. 74) suddenly showed mosaic, although no previous outbreak had been known in the district.

Streak disease of maize [ibid., ix, pp. 300, 767] is very severe in most plantations in Réunion, but though the sugar-cane variety R.P. 8 is affected almost throughout the island, it is practically the only cane that does show streak, even when other cane varieties usually considered to be susceptible are growing near it. Streak was experimentally transmitted by means of *Aphis maydis* from *Coix lacryma-jobi* (on which it is very common in Réunion) to R.P. 8 canes. It is carried from maize to maize by this insect, but not from maize to sugar-cane or from one variety of cane to another. In one locality where streak disease is very severe on maize, the diseased plants were covered with aphids, but heavily infected stools of maize placed near a cane variety generally regarded as susceptible did not spread infection, while oats very near affected maize did not contract the disease. Probably there are many different sources of the streak virus, each of which is accessible to only one species of insect. The authors suggest that 'carrier' hosts may exist which show no symptoms of the disease, but can serve as a source of inoculum.

KOPP (A.) & D'EMMEREZ DE CHARMOY (D.). **Trois maladies de la Canne nouvelles pour la Réunion.** [Three diseases of Sugar-Cane new to Réunion.]—*Stat. Agron. Réunion, Travaux Techniques, Bull.* 3, pp. 21–26, 1 map, 9 figs. [preceding p. 13], 1932.

After describing the symptoms of pokkah-boeng [*Gibberella moniliformis*] and twisted top of sugar-cane [*R.A.M.*, xi, p. 403], the authors state that the latter was exceedingly prevalent in Réunion in 1931, probably as a result of a cyclone followed by drought; in 1932 its incidence greatly diminished. Many serious cases of pokkah-boeng were noted in two localities on D. 74, and P.O.J. 2878 and 2714.

In 1931 and 1932 stem galls, which sometimes caused symptoms resembling witches' broom and sometimes merely a neoplastic growth with the structure of a rudimentary leaf [ibid., xi, p. 604], were noted on several sugar-cane varieties, especially R.P. 73 and P.O.J. 2878. On the latter, on which the condition was much the most marked, it always appeared during rainy weather on young suckers, seldom above the third or fourth internode. On R.P. 73 the neoplasm generally developed near the leaf scars along the

whole length of the cane, in any season and at any age. The excrescences never attained the size of those on P.O.J. 2878 and had a cauliflower-like appearance.

BELL (A. F.). **Banded (sectional) chlorosis associated with tangle top and death of Sugar-Cane.**—*Queensland Agric. Journ.*, xxxviii, 6, pp. 476–483, 6 figs., 1932.

This is a brief account of the sugar-cane trouble which was described from Cuba by Faris under the name 'cold chlorosis' [*R.A.M.*, vi, p. 184], but as the condition has since been observed in greenhouses, later authors have reverted to the original name of sectional chlorosis [ibid., ix, p. 203], and in 1929 Martin suggested the name banded chlorosis as more descriptive of the condition. It is stated to be extremely common throughout the winter months in New South Wales and central and southern Queensland in localities where the varieties M. 1900 Seedling and D. 1135 are grown extensively. In the northern section of the Queensland sugar-cane belt it is seen rather infrequently on Badila (which forms over 90 per cent. of the crop). While in susceptible varieties the injury caused by banded chlorosis may be such as ultimately to kill the plant, in resistant varieties it is limited to the inhibition of the development of chlorophyll in the affected areas, frequently resulting in a reduction by more than 50 per cent. of the effective leaf surface; as this reduction, however, occurs mainly during the dry, cold months of the year, when growth is practically at a standstill, it is not believed that the trouble causes any appreciable loss in tonnage.

HAMMARLUND (C.). **Beiträge zur Kenntnis der Mikromyceten-flora der Provinz Skåne (Schonen).** [Contributions to the knowledge of the micromycete flora of the province of Schonen.]—*Arkiv för Bot.*, xxv A, 2, No. 3, pp. 1–126, 3 pl., 1933.

The following records among this list of fungi (approaching a total of 2,000) of Schonen, the southernmost province of Sweden, are of special interest. *Olpidium pisi* n. sp. was found in the roots and hypocotyls of peas grown from seeds from France at the Landskrona Seed Testing Laboratory. The fungus is characterized by smooth, globular sporangia, 18 to 28 $\mu$ in diameter, usually occurring singly, rarely in groups of 2 to 4 in the epidermal cells, or occasionally in those of the parenchyma, the neck projecting up to 10 $\mu$; oval zoospores 4 by 2 $\mu$, each with one cilium up to 8 $\mu$ in length; and globular, smooth, thick-walled, resting spores with pale yellow contents, 14 to 20 $\mu$, germinating by zoospores, 4 by 2 $\mu$, each with a cilium up to 14 $\mu$ long.

*Viola tricolor* plants were attacked by a *Peronospora* apparently identical with *P. violae*, though the conidia were somewhat larger than those of the type species on *V. arvensis* (17·4 to 33 by 14·8 to 26·6 $\mu$, average 26·6 $\pm$ 0·4 $\mu$ by 19·8 $\pm$ 0·2 $\mu$, compared with 25 by 18 $\mu$). Possibly the species on *V. tricolor* (apparently a new host) may be a biologic form of *P. violae*, or it may be merely a question of a matrical modification affecting the fungus on a cultivated plant.

A celery seedling was severely infected by a species of *Pythium*, presumably *P. de Baryanum* though differing from the latter in several important respects. The profusely branching mycelium forms a thin, web-like coating over the surface of the plant and develops both inter- and intracellularly in the host tissues. The superficial branches often bear swellings of varying size (a few up to 40 to 47 $\mu$ in diameter) at their apices, possibly representing rudimentary sporangia, while a few intercalary, fusiform swellings may be undeveloped conidia. Celery leaves were also infected by *Protomyces inundatus.*

Bean (*Phaseolus vulgaris*) leaves and pods were attacked by *Ascochyta phaseolorum* [*R.A.M.*, vi, p. 715], of which two apparently different forms were found, one at Bunkeflo with spores measuring 10 to 12 by 3 to 4 $\mu$ and another at Landskrona (18 to 22 by 6 to 7 $\mu$), the former dimensions agreeing fairly well with those given by Allescher (10 by 3 $\mu$) and the latter with Lind's figures (20 to 25 by 6 to 8 $\mu$).

The detection in 1930 of the aecidial stage of *Puccinia mirabilissima* on *Mahonia* [*Berberis*] *aquifolium* [ibid., x, p. 109 and above, p. 293] necessitates an addition to the diagnosis of the rust, which is as follows. The spermogonia, measuring 110 to 120 $\mu$ in height and 100 to 115 $\mu$ in breadth, are immersed in the palisade tissue and form a group on the upper side of the leaf on the dark red lesions. The broadly infundibuliform aecidia generally occur in groups on the under side. The pseudoperidial cells are distinctly polyhedral and arranged in rows, their inner walls 2 to 3 $\mu$ in thickness, and the outer ones 10 to 16 $\mu$ prolonged to a long point almost covering the adjacent cell. The rounded to oval or slightly polyhedral aecidiospores measure 16·2 to 22·6 by 14·8 to 21 $\mu$ (average of 200, $20{\cdot}2 \pm 0{\cdot}1$ by $16{\cdot}0 \pm 0{\cdot}03\,\mu$), and have an evenly thickened wall about 1 $\mu$ in thickness all round.

UNAMUNO (L. M.). **Algunos micromicetos nuevos o poco conocidos de la flora española.** [Some new or little known micromycetes of the Spanish flora.]—*Bol. Soc. Española Hist. Nat.*, xxxii, 9, pp. 439–449, 1 fig., 1932.

Continuing his critical studies on the fungi collected in various parts of Spain, the writer here enumerates 32 species from the northern, central, and southern regions of the Peninsula [cf. *R.A.M.*, xi, p. 604]. The list includes 10 Sphaeropsidaceae and 15 Uredinales. *Phyllosticta mali* [*R.A.M.*, x, p. 296] was found producing round or elongated, pale to bleached spots, up to 10 mm. in diameter, on the upper side of apple leaves, which were seriously damaged by the fungus. *P. phaseolorum* forms spherical, concentric, pale to ochraceous-brown lesions, 6 to 20 mm. in diameter, with sharply defined, darker margins, on both leaf surfaces of beans (*Phaseolus vulgaris*), causing necrosis of the parenchyma. Both these records are new to Spain.

HÖHNK (W.). **A new parasitic Pythium.**—*Mycologia*, xxiv, 6, pp. 489–507, 1 pl., 5 figs., 5 graphs, 1932.

This is a detailed morphological account of a species of *Pythium*, considered to be new to science and furnished with a Latin

diagnosis, which was isolated from a soil sample taken from the surface at the waterline of a pond near Milton, Wisconsin, out of association with any visible plant growth. In pure culture, the fungus grew best on ant larvae, on which it developed within 2 or 3 days a mycelial weft 1 to 1·5 cm. in diameter, the main branches of which were about 6 μ in diameter. The zoosporangia are intercalary, rarely terminal, globose (21 to 34 μ) or ovate (22 to 29 by 19 to 24 μ), evacuating through a long tube. Most, however, become resting sporangia, also eventually evacuating as the former, or, on growing older, germinating by means of a germ-tube. Towards the end of the growth, gemmae of various shapes were also formed. Sexual organs appeared at the end of 36 hours in culture. Most of the oogonia were intercalary, 19 to 29 μ in diameter, and supplied each with an epi- and hypogynous antheridium, up to 18 μ long, both of which evacuated into the oogonium. The oospores, not completely filling the oogonia, were 14 to 22 μ (mostly 18 μ) in diameter and with a wall 1·5 μ thick.

The fungus, which is named *P. epigynum* n. sp., was shown in the laboratory to be pathogenic to seedlings raised from pea, bean, grass, and maize seeds grown in sterilized soil.

Matsumoto (T.), Yamamoto (W.), & Hirane (S.). **Physiology and parasitism of the fungi generally referred to as Hypochnus sasakii Shirai. I. Differentiation of the strains by means of hyphal fusion and culture in differential media.**—*Journ. Soc. Trop. Agric.*, Formosa, iv, pp. 370–388, 4 figs., 1932.

A full account is given of the writers' investigations on the physiology and parasitism of the group of fungi usually known as *Hypochnus* [*Corticium*] *sasakii* [*R.A.M.*, xi, p. 801], 17 strains of which were collected in Formosa on various hosts, including rice, sugar-cane, groundnut, French bean (*Phaseolus vulgaris*), cowpea, and camphor (*Cinnamomum camphora*). Two other strains (18 and 19) used in the studies were received as *Rhizoctonia* [*Corticium*] *solani* and isolated, respectively, from cotton seedlings in India [ibid., x, p. 661] and from 'scurf' of potato tubers in Germany.

All the first-mentioned 17 strains were determined as *C. sasakii*, although No. 17 from camphor was somewhat aberrant. Tests of the affinity of the organisms were carried out by the method of hyphal fusion in mixed cultures [cf. ibid., xi, p. 458], from which it was ascertained that Nos. 1 to 16 all fuse with one another and with strain 18 from cotton in India, while 17 only fused imperfectly with all the other strains except 19 (*C. solani* from potato), the last-named making no union with any of the other forms. It is concluded, therefore, that Nos. 1 to 16 and 18 are all more or less nearly related and determinable as *C. sasakii*, No. 17 more distantly allied, but referable to the same species, and No. 19 quite distinct (*C. solani*).

Chow (C. H.). **Septobasidium lanatum, nov. spec.**—*Ann. de Cryptog. Exot.*, v, 2, pp. 68–69, 2 pl. (1 col.), 1932.

Latin and French diagnoses are given of *Septobasidium lanatum* n. sp., collected on a tea branch in Cochin-China in 1931. The fungus is characterized by a homogeneous trama consisting of

loosely woven, branched, septate, hyaline to brown hyphae, 5 to 6 $\mu$ in diameter; brown conidia, usually moniliform but occasionally glomerulate, 5 to 7 $\mu$ in diameter; and hyaline, pedicellate, thin-walled, spherical cells, up to 20 $\mu$ in diameter, bearing basidia in various stages of development and apparently representing probasidia. The extremity of the pedicel penetrates the probasidium like a columella. These cells are similar to those found by Boedijn and Steinmann in *S. tuberculatum* in the Dutch East Indies [ibid., ix, p. 562]. Granular nodules up to 1 mm. in diameter are scattered in the thallus and invariably contain coccids.

CHRISTENSEN (C.). **Cultural races and the production of variants in Pestalozzia funerea.**—*Bull. Torrey Bot. Club*, lix, 9, pp. 525–544, 6 figs., 1932.

This is an expanded account of the writer's studies in Minnesota on the development of physiologic strains and *Monochaetia*-like variants in monospore cultures of *Pestalozzia funerea* isolated from long-leaf pine (*Pinus palustris*) leaves attacked by *Septoria acicola* [*R.A.M.*, xi, pp. 413, 813].

SMEE (C.) & LEACH (R.). **Mosquito bug the cause of stem canker of Tea.**—*Nyasaland Dept. of Agric. Bull.* 5 (N.S.), 7 pp., 3 pl., 1932.

The tea canker prevalent in Nyasaland [*R.A.M.*, xii, p. 9] has been found to be due to the mosquito bug (*Helopeltis bergrothi*) and not to a fungus as was previously believed [ibid., x, p. 707]. A description is given of the canker and its causation by the insect, control measures also being indicated.

VINSON (C. G.). **Mosaic diseases of Tobacco: V. Decomposition of the safranin-virus precipitate.**—*Phytopath.*, xxii, 12, pp. 965–975, 1932.

A fully detailed and tabulated account is given of the writer's experiments on the decomposition of the safranin-tobacco mosaic virus precipitate by Lloyd's alkaloidal reagent, a brief note on which has already appeared [*R.A.M.*, xi, p. 407].

JOCHEMS (S. C. J.). **Toprot en rotstelen bij Deli-Tabak (Bac. aroideae Townsend.)** [Top rot and hollow stalk in Deli Tobacco (*Bac. aroideae* Townsend).]—*Meded. Deli Proefstat. te Medan-Sumatra*, Ser. II, lxxix, 40 pp., 6 figs., 1932. [English summary.]

*Bacillus aroideae* was isolated from Sumatran tobacco plants affected by top rot and 'hollow stalk' and shown by inoculation experiments to be responsible for both conditions [*R.A.M.*, xi, p. 478]. The disease develops as a soft rot of the medulla of full-grown plants, causing the top leaves to wilt and the upper part of the stem to become hollow. In some cases the lower parts of the stem are similarly affected and the lower leaves collapse. The same organism was further shown to cause 'stem rot' in the drying shed. This is a wet decay of the midrib and large veins of green tobacco leaves, which commences immediately they have been hung up for curing. It is the most serious rot of tobacco in

the drying sheds. In severe cases the veins are so weakened that many leaves drop from the strings. Probably stem rot is introduced into the drying sheds by leaves picked from plants with hollow stalk. Cross-inoculations proved that the organism isolated from each disease was able to cause the symptoms of the other. It was also ascertained by experiments that stem rot is spread by the use of infected stringing needles and strings. The extension of hollow stalk may be arrested by refraining from topping the infected plants under conditions favouring the disease, while the incidence of stem rot may be reduced by thorough ventilation of the drying sheds and strict precautions against the use of leaves from hollow stalk plants.

Under very damp conditions wilt (*Bacterium solanacearum*) [ibid., xi, p. 477] may assume quite an atypical form characterized by a rotting of the pith of the stem that ultimately leads to the breaking off of the top. As a rule there are no external symptoms of necrosis. The midribs of diseased leaves may be slightly rotted at the junction of the leaf with the stem, but the foliage thus affected usually cures quite normally in the drying sheds.

MEURS (A.). **Proeven omtrent spikkelbestrijding, genomen in de jaren 1931 en 1932.** [Experiments in leaf spot control made in the years 1931 and 1932.]—*Meded. Deli Proefstat. te Medan-Sumatra*, Ser. II, lxxx, 21 pp., 1932. [English summary.]

Neither seed disinfection with various standard fungicides nor treatment of the soil of the seed-beds with 2 per cent. formalin proved effective against leaf spot (frog eye) of tobacco (*Cercospora nicotianae*) in Sumatra during 1931–2 [*R.A.M.*, xi, p. 477]. The occurrence of spots on the seedlings, however, was largely prevented by spraying them with Bordeaux mixture. The effect of spraying the field crop with Bordeaux mixture was confined to the leaves actually sprayed and did not extend to the rest of the plant. No deposit of Bordeaux mixture was left on the leaves at the time of fermenting when the rains were abundant, but in the absence of rain a brownish- or greenish-black, colloidal copper-containing residue remained on leaves sprayed more than 20 days after transplanting and completely spoiled them for wrapper purposes. The TL 13 strain of Deli tobacco was found to be slightly more susceptible to *C. nicotianae* than the others in common use, of which 8 is specially resistant.

JONES (L. K.). **The sources of the viruses that cause streak of Tomato.**—Abs. in *Phytopath.*, xxii, 12, pp. 999, 1932.

Tomato streak, as it occurs in Washington greenhouses, is stated to be caused by a combination of the latent potato and the common tobacco mosaic virus [cf. *R.A.M.*, xi, pp. 271, 808]. Once the disease appears on the plants it spreads very rapidly by pruning and cultural practices. The tobacco mosaic virus seems to be introduced into the greenhouses chiefly by the use of tobacco by workmen, though it may sometimes be transmitted to tomatoes from petunias, *Solanum nigrum*, or other hosts.

Day (W. R.). **The ink disease in England.**—*Forestry*, vi, 2, p. 182, 1932.

The author states that *Phytophthora cambivora* [*R.A.M.*, xi, p. 485] has been found since 1930 in a virulent form attacking chestnut trees in Hampshire and Herefordshire, and beeches in Somersetshire. There is no evidence to show how long the disease has been present in England, nor whether the fungus is indigenous, but in one locality at least it is known to have occurred for some time previous to its identification. The present virulent form, however, has appeared only recently, probably under the influence of certain particular conditions of the soil. Both the chestnut and the beech strain of *P. cambivora* have been shown to be parasitic on each of these hosts, but so far the beech has proved to be more resistant to both than the chestnut.

Peace (T. R.). **The Dutch Elm disease.**—*Forestry*, vi, 2, pp. 125–142, 1 map, 1932.

The chief point of interest of this paper is a brief historical outline of the spread in England of the Dutch elm disease (*Graphium* [*Ceratostomella*] *ulmi*) [*R.A.M.*, xii, p. 126] up to 1931, and a discussion of its marked decline in severity in 1932. Mention is also made of cases of recovery of the tree, the first of which were observed in 1929; until 1932 their number was small in comparison with that of new cases, and they tended to be more frequent where the disease was only slight, but in 1932 they greatly outweighed the number of new cases and occurred frequently even in the worst diseased areas. The recoveries studied were either complete, all traces of discoloration disappearing in the wood, or incomplete, the markings still being present in the wood. In the latter case, there was a suggestion that the fungus was slowly dying out.

Examination of a number of large elms in Cambridge, which were first thought to have the Dutch elm disease, showed that they were attacked by a species of *Verticillium* [(?) *V. albo-atrum*: ibid., xii, p. 125]. No other case, however, was found among over a hundred elms examined elsewhere, and it appears unlikely that this disease is at all common in England.

Cecconi (G.). **La moria degli Olmi.** [Die-back of Elms.]—*Rivista Agricola*, xxviii, 650, pp. 478–480, 1932.

After stating that die-back of elms (*Graphium* [*Ceratostomella*] *ulmi*) has been present in Italy for about three years [*R.A.M.*, xii, p. 200] and describing an experiment in which a large number of affected elms treated by him in June, 1931, rapidly recovered and were still healthy in October, 1932, the author lays down the following recommendations for control.

A careful watch should be kept, especially towards early summer, for the first symptoms. Directly these appear, the affected branches should be cut away and burnt. The wound surfaces, branches, and trunk down as far as the top of the main roots (which should be laid bare) should then be disinfected with a mixture consisting of 100 l. water, 8 kg. iron sulphate, and 1 kg. slaked lime. The soil should at once be replaced and the ground dusted with iron

sulphate to a radius equal to the length of the branches. When dry, the wounds should be painted or tarred over. Badly diseased trees should be felled, the bark removed and burnt, the wood cut up for firewood, and the cavity dusted with quicklime, mixing it into the soil.

**Legislative and administrative measures. Spain.**—*Internat. Bull. of Plant Protect.*, vii, 1, p. 11, 1933.

An Order of 17th November, 1932, provides for the formation of an Institute of Agricultural Research in Spain, comprising all the experimental centres hitherto under the general management of the Ministry of Agriculture. The activities of the centres are to be extended to research work. The Institute will be divided into eight sections, headed by phytopathology.

Britton (W. E.). **Regulations concerning transportation of nursery stock in the United States and Canada.**—*Connecticut Agric. Exper. Stat. Circ.* 86, pp. 45–74, 1932.

This paper contains a very useful summary of the regulations governing the transportation of nursery stock in the United States (with the District of Columbia) and Canada, the relevant Federal quarantines being cited and the requirements of each State in respect of various plant pests and diseases set forth separately. A list of officers in charge of inspection and quarantine service in the different States is appended.

**United States Department of Agriculture. Plant quarantine and control administration. Service and regulatory announcements. List of intercepted plant pests (List of pests recorded during the period July 1, 1931, to June 30, 1932, inclusive, as intercepted in, on, or with plants and plant products entering United States territory).**—pp. 173–244, 1932.

Among other interceptions made by officials of the plant quarantine and control administration of the United States Department of Agriculture during the period from 1st July, 1931 to 30th June, 1932 [cf. *R.A.M.*, xi, p. 544], the following may be mentioned: *Elsinoe canavaliae* on *Phaseolus lunatus* [var.] *macrocarpus* [ibid., xi, p. 618] from Jamaica; *Entyloma ellisii* on spinach from Cuba; *Mycosphaerella schoenoprasi* on leeks from Japan; *Phoma citricarpa* [ibid., xi, p. 450] on oranges from India, China, and Japan; and *Thielaviopsis* [*Ceratostomella*] *paradoxa* on *Eleocharis tuberosa* and *Sagittaria sagittifolia* from China.

**Legislative and administrative measures. Tunis (Regency of.)** *Internat. Bull. of Plant Protect.*, vi, 12, pp. 208–210, 1932.

By a Decree of 11th July, 1932, the Director-General of Agriculture, Tunis, is authorized to define by Order the plant and animal parasites dangerous to crops and to which the following measures are applicable. The importation into, circulation through, and transit across Tunis of all living plants or parts thereof contaminated by any of the parasites included in the above-mentioned Order is prohibited. This regulation further extends to the

packages used for such plants and any other objects or products liable to spread infection. All other plants must be accompanied by a certificate of health and origin and submitted to sanitary inspection by the competent authorities on arrival. Property owners or occupiers are required to notify the local administrative authorities of any abnormal condition or injury to crop plants by infectious parasites on their land. Should any of the parasites included in the Order be detected on private property, the Director-General may define the limits of the infected zone and appoint the necessary measures and treatments to prevent or check the development of infection. One or more annual inspections by phytosanitary experts will be made of nursery gardens and other horticultural establishments dealing commercially in plant material for propagation.

**Legislative and administrative measures. Australia (Commonwealth of).**—*Internat. Bull. of Plant Protect.*, vi, 12, p. 206, 1932.

By Quarantine Proclamation No. 215 of 5th May, 1932, the importation into Australia of plants of the genus *Humulus* from any country is prohibited. The importation is authorized, however, of the flower parts commercially known as hops provided they originate in a country where neither downy mildew (*Pseudoperonospora humuli*) nor hop mosaic is known to occur.

**Legislative and administrative measures. Germany (Province of Hanover).**—*Internat. Bull. of Plant Protect.*, vii, 1, p. 10, 1933.

Compulsory control measures in certain districts of Hanover against the asparagus fly (*Platyparea poeciloptera*) and asparagus rust (*Puccinia asparagi*) include by Decree of 10th October, 1932, the destruction of the shoots by 1st December each year or earlier if the rust develops at an early date [*R.A.M.*, x, p. 816]. Similar regulations are in force in Anhalt (Police Ordinance of 14th July, 1932).

**Legislative and administrative measures. Dominican Republic.**—*Internat. Bull. of Plant Protect.*, vii, 1, pp. 12–13, 1933.

In order to prevent the introduction into the Dominican Republic of the witches' broom disease (*Marasmius perniciosus*) of cacao occurring in Ecuador, Surinam, Trinidad, and probably elsewhere, the importation of living plants or parts thereof, seeds, and pods of cacao is prohibited by Presidential Decree No. 343 of 4th February, 1932 [cf. *R.A.M.*, x, pp. 144, 624], from the countries named, while no permits will be issued by the Ministry of Agriculture and Commerce for the importation of botanical material, seeds, or pods or living cacao plants from countries other than those specified unless the disease in question is known with certainty not to occur there.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW

OF

# APPLIED MYCOLOGY

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MILBURN (MARGARET) & GRAVATT (G. F.). **Preliminary note on a Phytophthora root disease of Chestnut.**—*Phytopath.*, xxii, 12, pp. 977–978, 1932.

A species of *Phytophthora* apparently identical with *P. cambivora* [*R.A.M.*, xi, p. 737; xii, p. 334] has been isolated from the blackened roots of dying American chestnuts (*Castanea dentata*) from Georgia, South Carolina, and Tennessee. The oospore stage of the fungus has not yet been observed in nature. The organism was isolated and used to inoculate greenhouse seedlings of *C. dentata* and *C. sativa*, killing 72 per cent. of the former and 74 per cent. of the latter in four months. The native *C. pumila* is also susceptible and the Japanese *C. crenata* and Chinese *C. mollissima* slightly so. So far no inoculations on the Chinese *C. henryi* and *C. seguinii* have succeeded. Two out of 81 inoculated seedlings of *Quercus prinus* became infected.

There is reason to suppose that *P. cambivora* has been present in the United States for many years, and that it is an important (possibly a primary) cause of the dying-off and recession of the chestnut at the lower altitudes in various localities from Maryland to Mississippi.

Considerable variation was observed in the symptoms caused by the fungus, some large trees wilting suddenly while others died gradually over a period of two years or more from the top downwards. The tap-roots were mostly more severely affected than the lateral ones, frequently exuding an inky slime. In some cases the roots were blackened only at their juncture with the crown, and on other trees isolated cankers were formed.

GOIDÁNICH (G.). **La verticilliosi dell' 'Acer campestre' L. e alcuni altri casi di tracheomicosi in Italia.** [Verticilliosis of *Acer campestre* L. and some other cases of tracheomycosis in Italy.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 3, pp. 285–297, 7 figs., 1932.

In August 1932 some four hundred two- to ten-year old *Acer campestre* trees growing under ideal conditions near Bologna

suddenly developed a serious wilt (verticilliosis), the same symptoms in a milder form later being observed on the same host over an extensive area in the vicinity. The affected trees withered and became prematurely defoliated. Sections of affected and apparently unaffected branches showed a chestnut to dark green or black discoloration in the xylem, with mycelium in the vessels; the bark was not loose and there was no exudate. A *Verticillium* with dark micro-sclerotia [*R.A.M.*, x, p. 757] was isolated from diseased material. Subsequently a similar species was isolated from *A. platanoides* showing a dark green discoloration of the wood [cf. ibid., viii, p. 424].

Brief notes are given on tracheoverticilliosis (from which species of *Verticillium* were isolated) on the following new hosts: *Chimonanthus fragrans*, *Euphorbia* sp., *Koelreuteria paniculata*, and *Lonicera biflora*. *Verticillium* tracheomycosis was also observed on *Fatsia japonica* [ibid., x, p. 149], *Papaver rhoeas* [ibid., iv, p. 495], phlox (*Phlox* (?) *pyramidalis*), and apricot [ibid., x, p. 150]. An extensive wilt of watermelons was due to *Fusarium niveum* [ibid., xii, p. 197].

Miller (P. W.). **Third report of progress of studies on Walnut blight and its control in Oregon.**—*Twenty-fourth Ann. Rept. Oregon State Hort. Soc.*, pp. 140–161, 1932.

Recent studies on walnut blight (*Bacterium juglandis*) [*R.A.M.*, xii, p. 253] in Oregon [ibid., vii, p. 176], where the loss of nuts from it reached 50 to 65 per cent. in certain localities in 1932, and an average loss for the State of 8 per cent. is estimated to have occurred even though the season was not a bad one for the disease, have shown (1) that the pathogen overwinters under local conditions primarily in diseased buds and in infections on the twigs; (2) that rain-water is the chief agent in the spread of primary and secondary infections; and (3) that the timely use of 3–3–50 Bordeaux mixture is an effective means of control. Rain during and shortly after the period of blooming is the chief factor in causing the initial attacks, which were observed from about the middle of May in 1932, the main damage occurring between 8th June and 6th July. No new infections were found after 12th September, and inoculations after 15th July failed. The best results were obtained by spraying (1) just before blooming of the pistillate flowers, and (2) immediately after blooming, when the stigmas of the pistils are turning brown. In cases of severe epidemics a third treatment about a fortnight after the second application is necessary to control blight. Dusting has so far not given sufficiently good results to recommend its use. Injury to nut-setting followed spraying with Bordeaux when the pistillate flowers were fully open to receive pollen. Growers appear generally to have profited by the increased yield and superior quality of the nuts due to Bordeaux treatment, which further reduced the number of hold-over infections.

Voglino (P.). **Le macchie nere del Noce.** [Black spots of Walnut.]—*La Difesa delle Piante*, ix, 6, pp. 85–86, 1932.

In the autumn of 1932 walnuts in the vicinity of Susa, Italy,

showed black spots near the veins on the young leaves, which spread until the whole leaf was involved, and also on the young branches, on which, however, they remained localized. The small fruits developed similar black spots, which eventually covered a large part of the surface, penetrating to the endocarp and causing premature dropping. The attack was favoured by rainy weather, and was most prevalent in low-lying, damp situations.

From the symptoms produced the author considers that the trees were infected by the well-known bacterial blight of other countries (*Pseudomonas* [*Bacterium*] *juglandis*) [see preceding abstract] especially as a bacterium was found in the necrosed tissues.

ALBEN (A. O.), COLE (J. R.), & LEWIS (R. D.). **New developments in treating Pecan rosette with chemicals.**—*Phytopath.*, xxii, 12, pp. 979–981, 1932.

Continuing their experiments in the control of pecan [*Carya pecan*] rosette in Louisiana by the injection of iron salts into the trees [*R.A.M.*, xi, p. 684], the writers found that the iron used contained appreciable quantities of zinc. In a test to compare the effects of zinc sulphate and zinc chloride solutions with those of iron sulphate, the new leaves of diseased trees were restored to their normal condition by dipping the terminal twigs in (or spraying the trees with) zinc sulphate or zinc chloride, while no improvement resulted from iron without zinc. The results are evidently similar to those of Chandler and his collaborators in the control of little leaf or rosette in fruit trees [in California: ibid., xii, p. 99]. The application of 2–2–50 zinc-lime [ibid., xi, p. 660] also benefited the trees, though to a smaller extent than zinc sulphate. The best results were obtained by the use of 0·18 per cent. zinc sulphate or 0·012 per cent. zinc chloride; the latter showed a marked tendency to burn the foliage when applied at higher concentrations.

FILIPPOFF (G. S.). Материалы по микофлоре слизетечений древесных пород. **1. Dissophora nadsonii nov. sp.** [Contributions to the mycoflora of slime flux of trees. 1. *Dissophora nadsonii* nov. sp.]—*Bull. Acad. des Sciences de l'URSS*, Leningrad, Ser. VII, viii, pp. 1155–1162, 1 pl., 3 figs., 1 diag., 1932.

This is a morphological, cultural, and taxonomic account of a species of Mucoraceae that was isolated in 1931 from a slime flux of cork oak (*Quercus suber*) in Soukhoum [Caucasian littoral of the Black Sea]. On beer wort agar the organism formed colonies of the type of *Mucor ramannianus* [*R.A.M.*, ix, p. 676]; the growth was most rapid and the colouring of the mycelium was most intense at 25° C., while at 7° to 10° the growth was slowed down but in the end the colony was more luxuriant than at any of the other temperatures tested; at 36° the growth was very poor. In its morphological details it approached closest *Dissophora decumbens* Thaxt., and is described as a new species of this genus, *D. nadsonii*. When grown in mixed cultures with *M. mucedo* and *M. hiemalis* it gave indications of parasitizing these moulds.

BADAMI (B. S. R.) & IYENGAR (C. S. R.). **The bio-chemistry of the spike disease of Sandal (Santalum album, Linn.) I. Note on the influence of chlorine on starch accumulation in disease. II. The role of manganese in health and disease.** —*Mysore Sandal Spike Invest. Ctte, Bull.* 2, 12 pp., 2 graphs, 1932.

A comparative examination in 1928–9 of the chemical composition of healthy and spike-diseased sandal (*Santalum album*) leaves from various parts of Mysore indicated that the chloride content of the latter is practically uniform throughout the year and consistently lower than that of the former. A low chloride concentration, therefore, co-exists with an excess of starch and a relatively increased diastatic activity in a diseased leaf [*R.A.M.*, ix, p. 277].

That spike disease is not due to a lack of manganese was shown by the fact that affected leaves contain, bulk for bulk, more of this mineral than healthy ones. This excess of manganese was found to bear no relationship to the availability of the metal in the soil in which the plants were growing. The course of protein synthesis was little affected by the presence of excess manganese in the leaves.

KALANDRA (A.). **Příspěvek ke studiu škodlivosti Botrytis cinerea Pers. v lesních školkách a semeništích.** [Contribution to the study of the damage caused by *Botrytis cinerea* Pers. in tree nurseries and seed-beds.]—*Ochrana Rostlin*, xii, 5–6, pp. 130–134, 2 figs., 1932. [French summary.]

A very brief account is given of a blight of conifer seedlings caused by *Botrytis cinerea* which is stated to be of rather frequent occurrence in Czecho-Slovakian nurseries, especially in seed-beds of *Pinus sylvestris*. Outbreaks of the disease are severe in dense stands, and most of the first-year seedlings may be killed. The blight may be easily controlled, however, by avoiding thick sowing and by measures directed towards promoting the health of the seedlings, such as proper choice and adequate fertilization of the soil for the seed-beds.

MOUNCE (IRENE). **Microscopic characters of sporophores produced in culture as an aid in identifying wood-destroying fungi.**—*Trans. Roy. Soc. Canada*, 3rd Ser., xxv, Sect. v, pp. 177–181, 1 pl., 1932.

The macroscopic characters of the rots and cultural characters of the sporophores of wood-destroying fungi were found by Hubert to afford satisfactory evidence of identity [*R.A.M.*, iv, p. 386]. The author has now established that a study of the microscopic characters of the sporophores may also be of value. The methods used for the examination of the sporophores were similar to those described in detail by Overholts (*Proc. Internat. Congr. Plant Sci., 1926*, ii, p. 1688, 1929). In some cases the sporophores are in themselves diagnostic, but as a rule they are reduced to a hymenial layer lining a few pores or covering some tooth-like projections, with no trace of a pileus and its distinguishing characters.

Sporophores developing in cultures of fungi isolated from infected wood may show distinguishing characteristics in the

following features: (*a*) type of basidia; (*b*) colour, shape, surface characters, and approximate size of spores; (*c*) presence of hyphal pegs, conducting organs, vesicular bodies, setae or cystidia, and their colour, size, and encrustation; and the colour reaction of the context in potassium hydroxide solution. These characters, combined with the information available as to the host and nature of decay, may limit the number of organisms to be studied in comparative cultures. Monospore cultures may also be made, paired with others of known origin, and submitted to the clamp-connexion test for specific identity.

The colour and shape of spores produced in culture are typical and the size usually falls within the limits of the species, although this character may be somewhat variable. The presence of brown cystidia in the pores of a fruit body developing in culture has been reported by Baxter for *Polyporus hispidus* [ibid., v, p. 265], and the writer has found the hyphal pegs of *P. anceps* [ibid., ix, pp. 149, 628] on the hymenium. According to Overholts (loc. cit.) many of the thin *Polystictus* types of *Polyporus* possess hyphal pegs, which are further present in a few species of *Favolus*, e.g., *F. brasiliensis*, and in *Trametes serpens*. The occurrence of these organs is thus particularly valuable for diagnostic purposes.

LACHMUND (H. G.) & HANSBROUGH (J. R.). **Preliminary report on the relative susceptibility of Sugar Pine and Western White Pine to blister rust.**—*Journ. of Forestry*, xxx, 6, pp. 687–691, 1932.

An experiment to determine the relative susceptibility to blister rust (*Cronartium ribicola*) under natural conditions of sugar pine (*Pinus lambertiana*) and western white pine (*P. monticola*) [*R.A.M.*, xi, p. 276] was initiated in 1926 at Daisy Lake, British Columbia. Three test plots with a total of 114 seedlings of the former and 177 of the latter species were laid out and inspected periodically between 1928 and 1931. In order to facilitate and accelerate the infection of the trees, numerous cultivated and wild bushes of the alternate hosts, black currant, *Ribes sanguineum*, and *R. bracteosum*, were transplanted in close proximity to the test plants, near which a few bushes of *R. lacustre* were already growing [ibid., xi, p. 553].

At the beginning of the investigation, the size and number of needles of corresponding trees of the same species were practically identical, but this relationship gradually changed until the sugar pines bore some 15 per cent. fewer needles than the western white pines. At the end of 1931 there were rather more than twice as many cankers per tree on the sugar pines as on the western white pines, suggesting that the former is at least equally susceptible with the latter to *C. ribicola* and probably more so.

DAY (W. R.). **Defoliation of Larch as a cause of disease.**—*Forestry*, vi, 2, pp. 113–124, 1 pl., 1 graph, 1932.

Continued studies in Bagley Wood, near Oxford [*R.A.M.*, xi, p. 140] lead the author to believe that much of the poor thrift there of the European larch (*Larix decidua* Mill.) [*L. europaea* DC.], Japanese larch (*L. kaempferi*), and three eastern Asiatic larches

(*L. gmelini*, *L. gmelini* var. *japonica*, and *L. gmelini* var. *Principis Rupprechtii*), is due to the detrimental action on the trees of what he terms permanent defoliation, i.e., that resulting from the killing by various agents, among which frost and birds are the most serious, of the growing points or whole shoots. There was evidence that in that locality the European larch is more liable to this type of injury, owing to complete destruction of many dwarf shoots, than the other species in which the tendency is for the shoot either to remain uninjured when the leaves are killed, or to have only its growing point killed, in which case two or more buds develop in the axil of the scale leaves, and a multiple dwarf shoot is formed. The chief fungal agent causing defoliation of larches in the wood in question is *Meria laricis* but this is rarely serious except in the nursery. Although *L. gmelini* and its two varieties are defoliated by frost almost every year, they have considerable powers of endurance in this climate, and appear to be more hardy than *L. europaea* in respect of liability to canker [*Dasyscypha calycina*: ibid., xi, p. 141] and to death of dwarf shoots on account of defoliation.

PEARSON (R. S.). **Report of the Director of Forest Products Research for the year 1931.**—*Rept. Forest Products Res. Board for the year 1931*, pp. 4–44, 8 pl., 2 figs., 1 graph, 1932.

This report gives a brief summary of work in progress on timber-rotting fungi and timber preservation at the Forest Products Research Laboratory, Princes Risborough [cf. *R.A.M.*, xi, p. 487]. The collection of wood-destroying fungi maintained in pure culture at the Laboratory now numbers over 160 species.

FINLAYSON (E. H.). **Report of the Director of Forestry 1931–2 (fiscal year ended March 31, 1932).**—*Dept. of the Interior, Canada*, Ottawa, F. A. Acland, 19 pp., 1932.

The following items of phytopathological interest, in addition to those already noticed from another source, occur in this report [cf. *R.A.M.*, xii, p. 123]. A laboratory test showed that wood-blocks impregnated with dinitrophenol and placed under running water for 30 days retain 44 per cent. of the preservative, indicating greater permanency under the same conditions than is shown by zinc chloride or copper sulphate.

The creosote treatment of fence posts [ibid., xii, p. 1] may be cheapened by floating the preservative in the treating tank on a strong solution of brine, which is thus absorbed by the lower part of the post, while the portion near the ground line, where protection is most needed, is permeated by the creosote. Incising was found to produce satisfactory results in the creosoting of red pine [*Pinus resinosa*] and jack pine [*P. banksiana*] by the hot and cold tank process [cf. ibid., xii, p. 70]. Water-soluble preservatives tend to ascend posts set in the ground, so that decay starts at soil level.

CAMPBELL (W. G.). **The chemistry of the white rots of wood. III. The effect on wood substance of Ganoderma applanatum (Pers.) Pat., Fomes fomentarius (Linn.) Fr., Polyporus**

**adustus (Willd.) Fr., Pleurotus ostreatus (Jacq.) Fr., Armillaria mellea (Vahl) Fr., Trametes pini (Brot.) Fr., and Polystictus abietinus (Dicks.) Fr.**—*Biochem. Journ.*, xxvi, 6, pp. 1829–1838, 1932.

A tabulated account is given of the author's further investigations on the chemistry of the white rots of wood [*R.A.M.*, xi, p. 342]. The experimental procedure and analytical methods were similar to those used in the previous studies, except in *Armillaria mellea* [ibid., xii, p. 130] on cherry (*Prunus avium*). Here it was necessary to determine the comparative specific gravity of sound and decayed wood by the technique of Hartmann and collaborators (*Journ. Amer. Ceramic Soc.*, ix, p. 298, 1926), involving the displacement of sand by samples of standard size and shape.

The fungi under investigation were divided into three groups as follows: (1) *Ganoderma applanatum, Fomes fomentarius, Polyporus adustus*, and *Pleurotus ostreatus* [ibid., xi, pp. 81, 684; xii, p. 44]; (2) *A. mellea*; and (3) *Trametes pini* and *Polystictus abietinus* [ibid., xi, p. 615]. The chemical bases for the three groups are as follows: (1) early attack on lignin and pentosans and delay in the disorganization of cellulose; (2) early disintegration of cellulose and its associated pentosans, and delayed attack on lignin; and (3) early decomposition of both lignin and cellulose in varying proportions. The material to be decayed by the fungi of group (1) consisted of fresh, air-dried, sterilized 60–80 mesh beech wood flour. In the samples inoculated with *G. applanatum* and *F. fomentarius*, fairly large, tough mycelial wefts developed on the surface, 2·76 gm. of mycelium (2·12 per cent.) being obtained from 130·32 gm. wood decayed by the former fungus and 3·93 gm. (3·02 per cent.) from the same weight of wood rotted by the latter. The total losses in weight caused by these organisms were 10·61 and 15·75 per cent., respectively.

The approximate loss of weight in the heart wood of cherry attacked by *A. mellea* was 25 per cent.

The effect of *T. pini* was observed on a sample of silver fir [*Abies pectinata*], the rot of which was found to be comparable to other white rots previously studied, while the analytical data agreed with those of Hawley and co-workers (*Cellulosechemie*, xi, p. 259, 1930) on the same fungus. According to Thaysen and Bunker [*R.A.M.*, vi, p. 500] *P. abietinus* causes a rot in which cellulose is depleted in the early stages, while the lignin is not attacked until decay is well advanced. The present data, however, do not support this statement. In the preliminary stages of decay, lignin is attacked to a proportionately greater degree than cellulose, while of the two pentosan groups those not associated with the cellulose are more liable to disintegration.

It is suggested that the ultimate primary reactions involved in all white rots are oxidation and hydrolysis, the main variants on which the above-mentioned subdivision depends being the incidence in point of time of such reactions, the course of possible secondary reactions, and the rates of the several reactions.

In the white rots the total alkali-solubility of the decayed wood as a percentage of oven-dry sound wood reaches a maximum and begins to decline at a much earlier stage than in the brown rots.

LINDGREN (R. M.), SCHEFFER (T. C.), & CHAPMAN (A. D.). **The chemical control of lumber and log staining and molding fungi.**—*Journ. of Forestry*, xxx, 6, pp. 714–721, 3 figs., 1932.

The following points of interest, in addition to those already noticed from another source, occur in this account of the authors' experiments on the chemical control of timber-staining (*Ceratostomella* spp.) and moulding fungi (mainly Moniliales) in the United States [*R.A.M.*, xi, p. 816].

In the Gulf States and Lower Mississippi Valley, where the chief losses occur, the sapwoods of pine and red gum (*Liquidambar styraciflua*) suffer the most extensive damage from the above-mentioned causes, yellow poplar (*Liriodendron tulipifera*), *Magnolia grandiflora*, black gum (*Nyssa sylvatica*), and oak being less susceptible. Freshly cut stock piled during warm, wet weather or without ample ventilation at any time of the year may be noticeably discoloured within 72 hours after sawing. Tests have shown that within 48 hours the stain organisms may be firmly enough established in the interior of the lumber to neutralize partially or wholly the efficacy of any treatments applied after that time. Stain development may be prevented by a reduction of the moisture content of the piled wood to about 20 per cent. of its oven-dry weight. In the case of logs in contact with the ground under humid conditions, the stain may penetrate 12 to 18 in. within three weeks after cutting and up to 6 ft. within three months.

The following large-scale chemical treatments gave satisfactory results: on pine, 0·01 per cent. solutions of ethyl mercury chloride and ethyl mercury phosphate, 0·37 per cent. sodium ortho-phenylphenolate, 0·48 per cent. sodium tetrachlorophenolate, and 5 per cent. soda; on hardwoods, the ethyl mercury and sodium tetrachlorophenolate treatments and 5 per cent. commercial borax. The immersion periods ranged from 10 to 15 seconds, and the solutions were kept at air temperature or at 160° F. The treatments can be applied at a cost of about 12 cents. per 1,000 board ft. of lumber, and one of the ethyl mercury compounds has been adopted on a commercial scale at over 100 mills in the United States, Canada, Mexico, and the Philippines. Logs may also be satisfactorily treated with creosote, the ends being coated with a mixture of cresylic acid and filled hardened gloss oil.

FRITZ (CLARA W.). **Division of Pathology.**—*Forest Products Laboratories of Canada. Programme of work 1932–1933*, pp. 23–31, [? 1932. Mimeographed].

In 1927 *Trametes pini* and two other unnamed fungi (2) and (3) were isolated from freshly cut jack pine [*Pinus banksiana*] sleepers showing a dark red stain, a defect that largely interferes with the value of this timber to the Canadian railway companies. *T. pini* occurred in 88·8 per cent. of the cultures. Sound blocks inoculated with fungus (2) rapidly developed red stain in pure culture. *T. pini* was found, in an examination of jack pine sleepers with white pocket rot [*R.A.M.*, xi, p. 614; xii, p. 123] to be less viable in seasoned than in green wood, the opposite being the case with fungus (2). Further investigations showed that red stain may be caused either by *T. pini* or fungus (2), but red rot

is the advanced stage of red stain due to the former only. In mechanical strength the red-stained wood is practically equal to sound material. Sleepers treated with creosote were found to be largely protected against secondary wood-destroying fungi, which are very active in untreated red-stained *P. banksiana* material.

It is estimated that the loss to white pine [*P. strobus*] users from blue stain fungi [*Ceratostomella* spp.] in 1928 (a warm, humid season) amounted to $1,000,000, the corresponding figure for normal years being $200,000 to $300,000. Good control of this defect was obtained in the Ottawa Valley by treatment of the wood with three organic mercury compounds, including ethyl mercury chloride and soda (lignasan) [see preceding abstract].

Conservative estimates indicate that the annual losses to the pulp and paper industry through deterioration of wood in the block pile reach at least $5,000,000. An examination of 50 sticks of pulpwood (25 of 1928 and 25 of 1930 storage) in Quebec showed 2·15 per cent. advanced rot, 28·80 per cent. incipient rot, and 30·45 per cent. sapwood stain in the former, the corresponding figures for the latter being 1·05, 22·79, and 6·33 per cent., respectively.

Scott (R. M.). **Preservative treatment of infected hardwood.**—*Commonwealth Engineer*, xix, 12, pp. 401–406, 4 figs., 1 diag., 1932.

The engineering departments of two semi-public bodies in Melbourne were recently put to considerable trouble and expense in sterilizing and preserving large stocks of jarrah [*Eucalyptus marginata*] and red gum [*E. rostrata*] blocks in which fungus infection (probably by *Coniophora cerebella*) was detected.

One affected stock consisted of 750,000 unused jarrah paving blocks that had been close stacked in the open for three or four years. The main infection (amounting to 25 per cent. or more in some of the worst cases) appeared as black rhizomorphs on the surface of the blocks. These organs spread with a vine-like growth in all directions and readily spanned gaps up to ½ in. across. In severe cases the blocks had been reduced to a pithy consistency or were even disintegrated. Three other forms of fungous infection were observed in these stacks, namely, bright orange strands, a pale yellowish, powdery growth, and a bluish-grey, felted surface growth, the two last being certainly moulds.

Owing to the high risk of infection consequent on the rapid spread of the black fungus, it was decided to sterilize all the blocks and apply a preservative to prevent recontamination. Two methods of treatment were successfully employed, namely (1) steaming and subsequently creosoting, and (2) cooking in creosote oil or other preservative. In method (1) 1,500 to 1,600 blocks were stacked, adequately spaced, in a flat-topped truck and steamed for two hours at 212° F. or for three hours at 160°, 100 per cent. relative humidity, the latter temperature being preferable as less likely to cause warping while equally toxic to the fungus. On completion of the steaming the blocks were dipped for several minutes in hot creosote oil. In method (2) the blocks were loaded haphazard into bitumen kettles containing tar-oil, where they

remained for 3 hours at 160°, $2\frac{1}{2}$ at 180°, and 2 at 210°. The capacity of the kettles was 800 to 900 galls., corresponding to 800 to 1,000 blocks. The tar-oil used comprised the heavier fractions distilling from coal-tar at 216° [*R.A.M.*, xi, p. 758].

The following results were given by compression tests of the ultimate strengths in end bearing: (*a*) sound blocks, average of 8 tests, 6,900 lb. per sq. in.; (*b*) partly infected (9 tests), 5,980 lb.; (*c*) badly infected (8 tests), 5,770 lb., the corresponding moisture contents being (*a*) 17·8, (*b*) 20·9, and (*c*) 15·9 per cent., respectively. In actual practice 10 galls. of tar were consumed for 960 large blocks, or 1·58 oz. per block. In no case had the oil penetrated below $\frac{1}{16}$ in. after two hours. The total cost of the treatment (including labour) was 5*s.* 4*d.* per 100 ft. super., or £1 4*s.* 9*d.* per 1,000 blocks, an expense regarded as fully justified.

OGILVIE (L.). **Investigations on vegetable diseases in the Bristol Province.**—*H*[*ortic.*] *E*[*ducational*] *A*[*ssoc.*] *Year Book*, i, pp. 45–48, 1932.

Brief, popular notes are given on the more important diseases of the following vegetables observed in the Bristol Province since 1930: asparagus, dwarf and runner beans [*Phaseolus vulgaris* and *P. multiflorus*], leeks, lettuce, mint, onions, parsnips, peas, and vegetable marrow [cf. *R.A.M.*, xi, p. 143].

ROCHLIN (EMILIA). **Zur Frage der Widerstandsfähigkeit der Cruciferen gegen die Kohlhernie (Plasmodiophora brassicae Wor.).** [Contribution to the question of the resistance of crucifers to finger-and-toe (*Plasmodiophora brassicae* Wor.).]—*Phytopath. Zeitschr.*, v, 4, pp. 381–406, 7 figs., 1932.

A comprehensive account is given of the writer's studies, conducted in 1930–1 at the Leningrad Plant Protection Institute, on the reaction to finger-and-toe (*Plasmodiophora brassicae*) of nearly fifty kinds of wild and cultivated crucifers [cf. *R.A.M.*, ii, p. 432; iii, p. 694].

The plants were set in soil heavily infested with the spores of the fungus and the percentage of infection ascertained. The highest degree of infection (100 per cent.) occurred in *Sinapis* (*Brassica*) *arvensis* [charlock or *B. sinapis*], the Braunschweig, Kopenhagen, and Amager cabbage varieties, *Hesperis lutea*, *Succovia balearica*, and *Carrichtera vella*, followed by *Barbarea rupicola* (99), *Iberis pinnata* (82), *Sinapis* [*Brassica*] *alba* (81), *Turritis glabra* (79), *Cochlearia danica* (75), *I. umbellata* (73), and a number of others with over 50 per cent. *C. officinalis*, *Thlaspi oliveri*, *Isatis glauca*, swede (S. Krasnosselski), *B. nigra*, two varieties of *Barbarea vulgaris*, *B. bracteosa*, *B. lyrata*, *Aubrietia olympica*, *A. deltoidea*, *H. alpina*, *H. fragrans*, and *H. matronalis* var. *nana* remained uninfected.

It is apparent from these data [which are tabulated] that the reaction of the hosts to *P. brassicae* is not determined by their systematic position within the crucifer family. A thorough investigation was accordingly made of members both of susceptible and resistant genera, paying special attention to anatomical structure (primarily of the root system) and chemical composition, with

a view to elucidating the factors conferring immunity from infection. Both resistant and susceptible plants were found to show a similar primary root structure, so that this character evidently plays no part in determining the reaction to finger-and-toe. In older plants, however, the penetration and spread of the parasite may be checked to some extent by the presence of periderm and collenchyma, as well as by a relatively compact xylem.

The entry of the parasite into the root hairs and epidermal cells [ibid., v, p. 529; x, p. 3; xi, p. 16] was studied chiefly in cabbage and *B. sinapis*, small plasmatic bodies, little larger than the spores, passing through the gelatinized wall which no longer stains blue with chlor-zinc-iodine at the point of passage. After three to five days the infected cells contain larger masses of loose, coarsely granular protoplasm. Subsequent spread in the tissues is effected both in an active and a passive manner, the former characterized by migration through the dissolved and disorganized cell walls, primarily of the cortical parenchyma and medullary rays, and the latter by the extension of the parasite by means of the division of the infected host cells. The swellings and excrescences on the roots are due to both hyperplasia and hypertrophy of the cells in the affected regions.

A study of the biochemical properties of the experimental plants showed that a protective action against the fungus is conferred by the strong-smelling glucosides yielding volatile mustard oils on splitting by the enzyme myrosin, viz., sinigrin, gluconasturtiin, glucotropaeolin, and glucocochlearin. In this connexion Sacharoff's observations (*Arb. Phytopath. Stat. Inst. für Landw. Moskau*, 1, 1916) are of interest, showing that infection by *P. brassicae* was most severe in turnips with an abundance of sugar in the cell sap, whereas those with an acid cell sap were immune.

PETERSEN (E. J.). **Undersøgelser over Bønnebakterioser i sommeren 1931.** [Investigations on Bean bacterioses in the summer of 1931.]—*Tidsskr. for Planteavl*, xxxviii, 5, pp. 826–856, 2 pl., 1932.

A serious bacterial disease of beans [*Phaseolus vulgaris*], not previously observed in Denmark, was reported from a number of nurseries and market-gardens during the summer of 1931 [*R.A.M.*, xi, p. 768]. The most prominent symptom was the development of yellowish-brown, later pure brown, dark-edged spots of irregular extent on the leaves. On the stems and petioles the lesions were reddish or brown and generally oblong. Plants attacked at an early stage of growth withered completely without forming pods. When infection occurred later small pods were formed, but they turned brown and shrivelled away without producing seed.

A rod-shaped bacterium was isolated from diseased plants, inoculated with positive results into Wax Flageolet seedlings, and reisolated from the latter. The best infections were obtained at a temperature of about 30° C. The organism occurs singly or in pairs, stains with fuchsin, methylene blue, and other basic aniline dyes, is Gram-negative, non-acid-fast, and measures 1·3 to 3·5 (average 2·3) by 0·8 $\mu$: gelatine is liquefied and milk peptonized. Good growth occurs on Difco agar (greyish-yellow, glistening,

fluorescent colonies) and a number of other standard media, Fermi's synthetic solution being specially favourable. The minimum temperature for growth is 5° to 7° and the maximum 38° to 42°; the optimum is not clearly defined but seems to range from 15° to 30°. The organism succumbs to ten minutes' exposure to a temperature of 46°, and is unable to survive anaerobic conditions. Development occurs at a hydrogen-ion concentration range from $P_H$ 5 to 8·4, the optimum lying between $P_H$ 5·7 and 6·4.

The systematic position of the bean organism is discussed at some length, the conclusion being reached that it falls between *Phytomonas* [*Bacterium*] *medicaginis* var. *phaseolicola* [ibid., xii, p. 1] and *P.* [*Bact.*] *viridiflava* [ibid., ix, p. 695], approaching more closely to the latter; it is therefore provisionally named *P. viridiflava* var. *concentrica*.

The organism lost virulence on culturing during six months, a further point in common with *Bact. viridiflava*. There is some indication that the green varieties of bean are more resistant than the wax ones to the bacterial disease under discussion. Infection is presumably carried on the seed and disseminated by various secondary agencies, such as rain and wind.

It is stated in a postscript to this paper that several species of *Phytomonas* were found in the summer of 1932 to be implicated in the causation of the bean disease. They were detected in beans purchased for seed, some samples of which were so heavily infected that they rotted away in the course of germination tests. A further report on these investigations is in preparation.

NEUWIRTH (F.). **Choroby vzcházející Řepy a pathologický význam jejich organických průvodců.** [Seedling diseases of the Beet, and the pathological significance of the organisms associated with them.]—*Ochrana Rostlin*, xii, 5–6, pp. 104–130, 7 figs., 1932.

By far the greatest part of this paper is a comprehensive review of the literature since 1859 dealing with the problem of the causation and control of the seedling root rots and blights of the sugar beet. A brief account is given of the author's inoculations of beet seedlings under controlled conditions with *Bacterium* [*Bacillus*] *mycoides* [*R.A.M.*, ix, p. 152] and *Rhizoctonia violacea* [*Helicobasidium purpureum*], both of which gave negative results, although the latter infected and rotted 4- or 5-months' old plants [ibid., xii, p. 135]. In 1926, which was an abnormally wet year in Czecho-Slovakia, he repeatedly isolated from blighted beet seedlings from various localities a species of *Acrostalagmus* which was also found in the seed clusters in 1927, although in that year it was not seen on any of the beet seedlings examined. In pure culture the fungus formed a dense, cottony, white aerial growth. The hyphae are very indistinctly septate, hyaline, and up to 3 $\mu$ thick. The conidiophores arising laterally on the hyphae are either erect or decumbent, simple or branched, and bear clumps of conidia at their apex which in some cases may be slightly swollen. The conidia which are formed successively, are agglomerated at the tip of the conidiophore by a slimy substance; they are hyaline, of greatly varying shape, and measure 3 to 5 by 1 to 1·5 $\mu$. The fungus is not named

and its pathogenicity was not tested. The author also made a few inoculation experiments with *Penicillium crustaceum* and *Rhizopus nigricans*, both of which attacked and killed young beet seedlings grown under conditions favouring the fungi.

DANA (B. F.). **Some experiments with mechanical transmission of the curly-top virus.**—Abs. in *Phytopath.*, xxii, 12, pp. 997–998, 1932.

The writer has used a modification of Sein's multiple needle technique for the transmission of sugar-cane mosaic [*R.A.M.*, ix, p. 678] for the transference of the curly top virus from sugar beet [ibid., xii, p. 195] to sugar beet, tomato, and spinach, and from tomato to sugar beet. The first attempt to transmit the virus from a recently diseased to healthy sugar beet was successful in 8 out of 16 plants in one lot, but trials at a later stage gave a low percentage of positive results. This was also the case in the transmission experiments from sugar beet to tomato and spinach and from tomato to sugar beet. The virus is evidently most active soon after its introduction into a plant, at which time also it is more readily transferable from one host to another than at any subsequent period.

COSTA (T.). **Su alcune prove di lotta contro lo Cercospora beticola eseguite a Monzon (Huesca) per conto della 'Compañia de Industrias Agricolas'.** [On some control experiments against *Cercospora beticola* conducted at Monzon (Huesca) on behalf of the 'Agricultural Industries Company'.]—*Indus. Sacc. Ital.*, xxv, 12, pp. 535–538, 1932.

Continuing his experiments on the control of leaf spot of sugar beets (*Cercospora beticola*) in Spain [*R.A.M.*, x, p. 427], the writer gave the following treatments: (1), (2), and (3) spraying with 2 per cent. Bordeaux mixture every 10, 20, or 30 days beginning 1st June, 1st July, and 1st August, respectively; (4) one series of plots (A) sprayed with 2 per cent. Bordeaux mixture every 10 days from 1st June, (B) every 20 days at 0·5 per cent., and (C) every 30 days at 0·5 per cent. to 1st August, and from 10th August onwards at 0·2 per cent. All the tests were discontinued in October.

The following results [shown in tabular form] were obtained. Series (1) average weight of beets sprayed at 10-day intervals, 439 gm., average sucrose 15·11 per cent., and total sucrose 66·33 gm., the corresponding figures for the 20-day interval being 375 gm., 14·93 per cent., and 55·98 gm., and for the 30-day 354 gm., 13·89 per cent., and 49·17 gm., respectively, while the control figures were 359 gm., 11·97 per cent., and 43 gm. In series (2) the average weight in the 10-day interval plots was 390 gm., average sucrose 14·89 per cent., and total sucrose 58·07 gm., the corresponding figures for the 20-day interval being 389 gm., 14·08 per cent., and 54·77 gm., and for the 30-day 420 gm., 13·53 per cent., and 56·73 gm., respectively, while the control yielded 393 gm., 11·79 per cent., and 46·31 gm. In series (3) the average weight in the 10-day interval plots was 370 gm., average sucrose 14·81 per cent., and total sucrose 54·79 gm., the corresponding figures for the 20-day interval

being 441 gm., 14·51 per cent., and 63·98 gm. and for the 30-day 394 gm., 13·66 per cent., and 53·82 gm., respectively, while the control produced 342 gm., 12·03 per cent., and 41·14 gm. In series (4) the (A) plots gave an average weight of 400 gm., average sucrose 16·10 per cent., and total sucrose 64·40 gm., the corresponding figures for (B) being 405 gm., 15·21 per cent., and 61·60 gm., for (C) 399 gm., 14·37 per cent., and 57·33 gm., and for the control 410 gm., 12·60 per cent., and 51·66 gm.

It is evident from these data, that notwithstanding the heavy rains in June and July, which somewhat neutralized the effects of the spray, the differences in yield and purity between the treated and untreated beets were very considerable. As in previous trials, the importance of an early start and frequent applications was apparent. The unsprayed plots suffered severely from the attacks of the fungus.

In a separate experiment a Polish E strain was planted side by side with a Polish Z strain, a portion of each being treated with 2 per cent. Bordeaux mixture at 10-day intervals from 1st July onwards. Analyses made at fortnightly intervals from 15th August to 30th October showed that the high sugar strain Z loses relatively less in sugar weight than the high yielding strain E. On 15th August the average weights of the leaves and roots of Z (control) were 415 and 327 gm., respectively, sucrose 12·08 per cent., the corresponding figures for the sprayed plot being 448 and 296 gm. and 11·51 per cent., respectively. On 30th October the average leaf and root weights of Z (control) were 49 and 402 gm., respectively, sucrose 12·79 per cent., the corresponding figures for the sprayed plot being 111 and 386 gm. and 15 per cent., respectively. The following values were obtained for E: average weight of leaves and roots on 15th August (control) 432 and 355 gm., respectively, sucrose 10·88 per cent.; 30th October 49 and 447 gm. and 10·48 per cent., respectively. Sprayed plot: 15th August, leaves and roots 406 and 296 gm., respectively, sucrose 10·79 per cent., the corresponding figures for 30th October being 152 and 457 gm. and 12·93 per cent., respectively.

Böning (K.). **Das Schwarzwerden der Rettiche.** [The blackening of Radishes.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz*, x, 9–10, pp. 205–219, 8 figs., 1932.

Radishes in the Munich district and other parts of south Bavaria have recently been severely attacked by *Aphanomyces raphani*, the causal organism of 'black root' in the United States [*R.A.M.*, viii, p. 606]. The first symptom of infection is a faint greyish-blue, translucent discoloration of the subepidermal root tissues, which generally advances chiefly in a transverse direction and remains confined to the outer layers. In this way the lesions frequently assume the appearance of bands of varying breadth partially or wholly encircling the tap root. The infection gradually spreads inwards, producing a bluish-black discoloration, accompanied by various malformations due to the unequal growth of the diseased and healthy portions of the radish. The affected epidermal and subepidermal tissues are liable to rupture, giving rise to lenticular fissures that may ultimately involve the deeper

layers. Here infection proceeds primarily in a radial direction, the medullary rays being extensively invaded, while the cambial zone often remains intact so that further growth is possible. The decay caused by *A. raphani* is of the dry type, but secondary infection by bacteria may eventually lead to the softening and disintegration of the root. In seedlings and young plants the disease may appear on the hypocotyl, cotyledonary leaves, petioles, and leaf blades in the form of dark stripes and markings, causing atrophy, yellow discoloration, and sometimes the death of the affected parts. This form of infection appears to occur in the soil at a very early stage of germination.

The writer's observations on the morphology and mode of infection of the radish parasite agree with those of Kendrick in the United States [ibid., vii, p. 4]. The fungus invades the roots from the soil chiefly through the natural wounds made by the emergence of the lateral roots, another favourable site for infection being the ruptured parts of the primary hypocotyl. Wounds inflicted by insects or implements also give ready access to the pathogen, which further seems capable of attacking completely sound tissues. Infection probably takes place by means of zoospores. The oospores develop in the outer layers of the diseased radishes, on the disintegration of which they are introduced into the soil and there act as a source of primary infestation. The disease is then perpetuated by the plant débris, which is thrown on to the manure heap and later used in frames or on the field. The frequent neglect of crop rotation in market-gardens is an important factor contributing to the prevalence of black root, which is further favoured by the excessive use of stable manure as a fertilizer. Experiments showed that the incidence of infection was much higher during the hot weather in July than at the lower autumn temperatures.

The Eiszapfen [Icicle] and a number of other early forcing white varieties were found to be highly susceptible to *A. raphani*, while some of the later summer red types showed a fair degree of resistance.

Control measures based on improved methods of cultivation are outlined. Moderately successful results were obtained in soil disinfection tests by the use of 2 per cent. formalin or calcium cyanamide (50 gm. per sq. m.).

DANA (B. F.) & MCWHORTER (F. P.). **Mosaic disease of Horse-Radish.**—Abs. in *Phytopath.*, xxii, 12, pp. 1000–1001, 1932.

Degeneration in the form of dwarfing and yellowing was observed among the horse-radish plantings of Oregon during 1930–1. The roots were small, with rough, scaly surfaces and were rendered unsaleable by their pithy texture and dark streaking. The foliage of root cuttings from diseased plants, potted and forced at different temperatures, was more or less stunted, the leaf blades showing a pronounced filiform segmentation. The young leaves exhibited a noticeable mosaic-like mottling, characterized by pale green interveinal areas interspersed with dark green, but no apparent clearing of the veins. The old leaves developed black, elongated lesions in the epidermis and outer cortex of the petioles.

In cross-inoculations on turnip and mustard by a modification of Sein's multiple-needle method [see above, p. 349], 100 per cent. of the plants contracted symptoms similar to those on horse-radish within 10 to 12 days.

BOURIQUET (G.). **Les maladies du Manioc à Madagascar.** [Cassava diseases in Madagascar.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 8–9–10, pp. 290–297, 1 pl., 1932.

This is a brief morphological and economic account of the chief diseases of cassava in Madagascar, namely, mosaic [*R.A.M.*, xi, p. 762], leaf spot (*Cercospora cassavae*) [ibid., xi, p. 130; xii, p. 137], a die-back of the twigs (*Gloeosporium manihotis*) [ibid., xi, p. 97], and root rot (*Phaeolus manihotis*) [ibid., xi, p. 492]. Control measures are briefly discussed in each case.

LAMBERT (E. B.). **Mushroom growing in the United States.**—*U.S. Dept. of Agric. Circ.* 251, 34 pp., 14 figs., 3 graphs, 1 map, 1932.

In addition to instructions for the cultivation of edible mushrooms (*Agaricus* [*Psalliota*] *campestris*) [cf. *R.A.M.*, xii, p. 72] in the United States, notes are given on the following diseases of this crop and their control; bubbles (*Mycogone perniciosa*) [ibid., xii, p. 198], bacterial spot (*Bacterium* [*Pseudomonas*] *tolaasii*), green mould [? verdigris caused by *Aspergillus*, *Penicillium*, and *Trichoderma* spp.: ibid., xi, p. 493], white plaster or flour mould (*Monilia* [*Oospora*] *fimicola*), and truffles disease (*Pseudobalsumia microspora*).

VILLEDIEU (G.). **Cuivre et mildiou.** [Copper and mildew.]—*Prog. Agric. et Vitic.*, xcviii, 49, pp. 536–539, 1932.

The author states that the experience of the severe vine mildew [*Plasmopara viticola*] epidemic of 1932 in France gave a striking confirmation of his views on the action of Bordeaux mixtures on the fungus [*R.A.M.*, iv, p. 297], and again demonstrated the necessity of spraying the vines after each heavy rain, if the disease is to be effectively controlled. While for the first two days the basic mixtures owe their activity to the free lime, and are then active as a result of the concentration of their soluble salts, the final action is one of contact with the insoluble basic copper compounds. When treated parts have been washed by heavy rain, the remaining deposit can only protect the exact spots it covers. A new spraying is required if the parts are to be adequately protected. At the same time, he reiterates his opinion [ibid., x, p. 156], which is supported by Schaffnit's recent work [ibid., xi, p. 799], that excessive fertilization of the vines with nitrogen renders them more susceptible to mildew.

CHRESTIAN (J.). **Algeria: Phoma flaccida on Vine.**—*Internat. Bull. of Plant Protect.*, vi, 12, pp. 201–202, 1932.

Attention is drawn to a severe outbreak of *Phoma flaccida* [*R.A.M.*, x, p. 642] on vines in the Mitidja plain, Algeria, where the fungus has hitherto been known only in a relatively mild form. Much of the damage resulted from infection of the stalks

of the bunches, causing the grapes to wither. The Aramon, Hybrides-Bouchet, and Carignan varieties were chiefly affected. The spread of the organism is thought to have been favoured by the abnormally cool and wet spring and summer of 1932.

PFEIFFER. **Die auffallend verbreitete Verfärbung der Rebenblätter im Jahre 1932.** [The remarkably widespread discoloration of Vine leaves in the year 1932.]—*Zeitschr. für Obst-, Wein- und Gartenbau*, lviii, 12, pp. 246–248, 1932.

Leaves of all types of vine, both black and white, showed an extensive red and yellow discoloration during 1932 in Germany, especially on sandy soils in which the usual fertilization had been omitted for the first time for some years. The residues of previous applications of potash salts were found to have accumulated in the upper layers of the soil, with the result that the plants absorbed excessive amounts of this mineral unbalanced by other nutrient materials, and metabolic disturbances ensued. The symptoms were most marked among widely-spaced vines exposed to direct sunlight. It is recommended that stable manure should be applied during the transition from a complete to a restricted fertilizing scheme.

SALMON (E. S.) & WARE (W. M.). **Department of Mycology.**—*Journ. South-Eastern Agric. Coll., Wye, Kent*, xxxi, pp. 13–21, 1933.

In 1932, the edges of the heart leaves of lettuces in Sussex were attacked by *Bacterium marginale* [*R.A.M.*, xi, p. 143]. The plants were cut in the morning with the dew on them and sent in sacks to the coastal towns; on the following day the hearts were found to be slimy or rotting, so that the lettuces were unsaleable. As the bacteria were perhaps splashed on to the leaves by rain, it was recommended that straw should be placed between the rows.

In November, 7-year old Worcester Pearmain apple trees near Dartford showed the presence of *Helicobasidium purpureum* round the trunks at ground level. The fungus was a dull or brownish-purple with a white fringe. It was not found on the roots or in the soil, but was noted on the stems of 8-year old interplanted gooseberry bushes, 1 to 2 in. below to 2·5 in. above soil level, completely encircling the stems and covering the fork of the lowest main branches. No damage was noticed on either host.

*Monilia* [*Sclerotinia*] *cinerea* f. *mali* caused considerable injury to Allington Pippin and other apple varieties in East Kent and an almost total loss of blossom on old Lord Derby trees. Several instances of eye rot from which a *Fusarium* was isolated were encountered, especially on Worcester Pearmain, though Lane's Prince Albert was also affected. The eye rot of Worcester Pearmain apples has been shown by Dillon Weston to be due to the *Fusarium* stage of *Nectria galligena* [ibid., vi, p. 424].

Groups of sporophores of *Pholiota squarrosa* were present at the base of some 10 per cent. of a number of 50- to 100-year old cherry trees that were dying off branch by branch.

Mushrooms infected by *Dactylium dendroides* were received;

the results of laboratory inoculations tended to support the view that the organism is parasitic on mushrooms.

Hop downy mildew (*Pseudoperonospora humuli*) [ibid., xi, p. 471] was completely controlled by systematic spraying which was carried out by about 80 per cent. or more of the Kentish growers. A disquieting feature was the appearance of mycelium in the 'hill', which sometimes resulted in the death of the plant.

**Trabajos de las Estaciones de Fitopatología agricola en el año 1931.** [Work of the Stations of Agricultural Phytopathology in the year 1931.]—*Bol. Pat. Veg. y Ent. Agric.*, vi (*1931*), 23–26, pp. 171–198, 1932.

A study is in progress at the Madrid Central Station of Agricultural Phytopathology on the deterioration of chilli pepper [*Capsicum annuum*] associated with three different conditions, namely, fusariosis, common mosaic [*R.A.M.*, xi, p. 804], and a virus disease distinct from the foregoing, the last-named being the most serious. In Valencia and Catalonia the same plant suffers from a disease known as 'whitewash' [ibid., xi, p. 281], the leaves, shoots, and fruit peduncles attacked by which yielded a species of *Alternaria*. Selected seed from apparently healthy plants from Rioja failed to maintain its resistance to the disease at the Valencia Station of Agricultural Phytopathology, where severe infection occurred. Various other fungi have been isolated from diseased chilli plants at the Madrid Station, so that the exact cause of the 'whitewash' requires further investigation. A similar disease has been observed on broad beans [*Vicia faba*] in Valencia, where heavy losses from this source have been reported. The symptoms include loss of chlorophyll, reduction of foliage, incomplete ripening of the seed, and general decline of vitality.

An attempt to isolate *Blepharospora* [*Phytophthora*] *cambivora* from diseased chestnut and vine material from Lugo gave negative results. The latter plant, however, yielded mycelium and a profusion of rhizomorphs, probably of a Hymenomycete which may well be the agent of the disease. An apparently new vine disease occurring in Almeria and known as 'yellows' is attributed to a species of *Stereum*.

Melons in the Masalfasar and Alboraya districts of Valencia suffer from a gummosis which kills the affected plants in a few days. The causal organism is believed to be a species of *Fusarium* entering the plants through the secondary roots.

THOMPSON (A.). **Division of Mycology. Annual Report for 1931.**—*Dept. of Agric. Straits Settlements and Fed. Malay States* (*Technical Reports for the year 1931*), *Bull.* 12, *Gen. Ser.*, pp. 48–52, 1933.

In 1931, stem rot of oil palms, due to the *Fomes* responsible for brown root rot of tea and rubber [*F. noxius*: *R.A.M.*, xi, p. 769; xii, p. 55], was fairly common on most of the older properties in Malaya. Tissues exposed by pruning were satisfactorily protected by a mixture of asphalt and oil. Crown disease and bud rot [ibid., vii, pp. 164, 165] of the same host were also reported, and *Maras-*

*mius palmivorus* was also prevalent on the palms but did not seriously damage the fruits [cf. ibid., xi, p. 354].

A tea disease resembling brown root rot was reported from Banting. Slime disease [*Bacterium solanacearum*] and *Cercospora* leaf spot [*C. nicotianae*] were the most prevalent diseases of tobacco, the former affecting, on an average, 6 per cent. of the plants. *Piper betle* was appreciably damaged by *Phytophthora colocasiae* [ibid., viii, p. 675; ix, p. 809] and *Sclerotium rolfsii*: weak Burgundy mixture is being used as a soil fungicide in affected areas. A *Rosellinia* was recorded on camphor, *Phoma camelliae* on tea, and *Rhizoctonia* [*Corticium*] *solani* on carrots and Bermuda grass [*Cynodon dactylon*]. The commonest mould-producing fungi on copra [ibid., xi, p. 175] were six species of *Aspergillus*, though *Penicillium glaucum*, *Trichothecium roseum*, and a *Rhizopus* (? *R. nigricans*) were also found, as were (occasionally, on poorly dried copra) a *Cephalosporium*, a *Colletotrichum*, a *Diplodia*, and *Ceratostomella adiposum* [ibid., ix, p. 612].

**Report of the Director for the year ending October 31, 1931.**— *Connecticut Agric. Exper. Stat. Bull.* 337, pp. 451–493, 11 figs., 1931. [Received March, 1933.]

The following items of phytopathological interest occur in this report. Chestnut trees inoculated with cultures of the blight fungus [*Endothia parasitica*] kept alive saprophytically for 20 years failed to contract infection, which developed, however, in those inoculated with cultures up to two years old. It is hoped that this gradual loss of virulence in old saprophytic cultures may be paralleled under natural conditions, in which case the return of the chestnut to its former prominence in the State is not impossible [*R.A.M.*, xi, p. 161]. At present all the old trees are either dead or dying of blight, but a few healthy sprouts that have survived the disease are found scattered through the woods, which further contain a fair number of seedling chestnuts apparently free from infection. No case of true resistance to the fungus has yet been observed in the native trees under Connecticut conditions.

When healthy cabbage and cauliflower plants were set in soil inoculated with the finger-and-toe organism [*Plasmodiophora brassicae*], 100 per cent. infection developed, the percentage being reduced to 26 and 16, respectively, by the application of $1\frac{1}{2}$ and $2\frac{1}{2}$ tons of hydrated lime per acre. In a greenhouse test, only 15 per cent. of the seedlings in a limed section contracted the disease, as against 50 per cent. in an unlimed.

Amongst the interesting records of diseases reported are the anthracnose of peas (*Gloeosporium* [*Colletotrichum*] *pisi*) [ibid., v, p. 69; vi, p. 273; vii, p. 359], and black root rot [*Thielaviopsis basicola*] on lilac and peony.

The willow scab fungus (*Fusicladium saliciperdum*) [*Venturia chlorospora*] reappeared with great severity after a temporary decline the preceding year [ibid., xi, p. 161]. The common yellow twig variety [*Salix alba* var. *vitellina*] is gradually dying out as a result of infection, especially in the Norfolk district.

Cultivated willows of the golden weeping variety [*Salix babylonica* var. *aurea*] developed heavy infection 12 days after

inoculation with a *Septomyxa*-like fungus, which has been found in Connecticut though the actual material for investigation was sent from New York. The weeping willow (*S. babylonica*) was only slightly susceptible and the Lemley variety very resistant.

Extensive damage was again caused by the lawn fungus [*Helminthosporium* sp.: loc. cit.], the outbreaks of which were of unprecedented intensity, especially on bent [*Agrostis* spp.], being favoured by hot, damp weather.

During the summer of 1931 some 85,000 wild and 8,500 cultivated *Ribes* bushes were destroyed over 4,500 acres in connexion with the white pine [*Pinus strobus*] blister rust [*Cronartium ribicola*] eradication campaign [loc. cit. and ibid., xii, p. 203]. It is estimated that one or more re-eradications will be necessary at five- or eight-yearly intervals. In three towns all the European black currants [*R. nigrum*] were destroyed, the possession of this plant being illegal in the State [see below, p. 381], while 4,632 wild and 255 cultivated *Ribes* bushes were removed from 17,664 acres of the nursery sanitation zones for the cultivation of healthy stock, which now number eleven.

**Fifty-first Annual Report of the Ohio Agricultural Experiment Station for the year ended June 30, 1932.**—*Ohio Agric. Exper. Stat. Bull.* 516, 128 pp., 2 pl., 7 figs., 3 graphs, 1933.

In the section of this report dealing with botany and plant pathology (pp. 37–45) H. F. Winter and H. C. Young state that hydrophilic colloidal sulphur [*R.A.M.*, xi, p. 427] was found to be toxic to a number of fungi, including *Glomerella cingulata*, *Sclerotinia cinerea*, *Mycosphaerella pomi*, and *Cladosporium fulvum*, most of which are highly resistant to ordinary, finely ground sulphur. Its chief drawback is that it crystallizes rapidly and is then no more toxic than flowers of sulphur. Dried skimmed milk increased the effectiveness of the colloidal sulphur more than any other protective agent tested.

J. D. Wilson reports that carrot leaf spot (*Cercospora apii* [var.] *carotae*) [*C. carotae*: ibid., viii, pp. 352, 630] and leaf blight (*Macrosporium carotae*) [ibid., x, p. 436] have for several years caused serious losses in northern Ohio. One field planted late in April was sprayed with Bordeaux mixture (4–6–50) plus calcium caseinate (1 in 50) on 15th June, when the plants were about 6 in. high, further applications being made at intervals of about ten days on dates which happened to cover the period of heaviest summer rain. When the field was harvested at the end of September it was found that spraying had increased the yield from 544 to 907 bushels per acre; the unsprayed plants were almost defoliated, whereas the sprayed ones were tall, healthy, and green.

Complete control of gladiolus scab (*Bacterium marginatum*) [ibid., xi, p. 428] was obtained by P. E. Tilford as a result of immersing the corms (Francis King and 1910 Rose varieties) for two hours in mercuric chloride (1 in 1,000) or for 5 minutes in calogreen (1 lb. per 2·5 gal. water) [ibid., xi, p. 699]; the untreated controls had 24·4 per cent. severely scabbed.

Tests by L. J. Alexander in the control of tobacco seedling root diseases showed that when 6 per cent. formaldehyde dust was

thoroughly worked into the top four inches of the seed beds at the rate of 3 oz. per sq. ft., the seed then sown and the bed thoroughly watered immediately, the plants which grew up subsequently were dark green, large, all fit for transplanting and compared favourably with others in a steamed bed; the plants in the control plot were worthless.

Two years' tests by R. C. Thomas gave good results in eradicating the fireblight organism [*Bacillus amylovorus*] from cankers by painting them with a solution obtained by dissolving 9 lb. dry zinc chloride powder in 1 qt. water containing 3 oz. hydrochloric acid, heat being used to expedite solution. When dissolved and cooled the mixture was poured into 7 pints of denatured alcohol and stored. This treatment obviated the necessity of cutting out the infected parts.

H. F. Winter reports that the results obtained in the seventh year of the campaign against raspberry diseases again demonstrated that a properly executed system of isolation, inspection, and roguing controls virus diseases [ibid., xi, p. 428]. Some 95 acres of black raspberries [*Rubus occidentalis*] on 26 farms in all parts of Ohio were inspected and rogued four times in 1932. The total number of plants affected with virus diseases was 0·75 per cent. of the Cumberlands and 0·25 per cent. of the Plum Farmers.

Celery yellows (*Fusarium* sp.) [ibid., viii, p. 23] was observed by J. D. Wilson in epidemic proportions in Ohio twice in 1930. In August, 1932, the Golden Phenomenal and Hoover Special varieties were about 90 per cent. diseased, the tall strain of Golden Self Blanching was about 20 per cent. infected, while two strains of Wonderful and Golden Plume showed only 6 to 8 per cent. loss. A dwarf, disease-resistant selection (A.A. 2530) from Michigan State College as well as Golden Prize and Early Fortune showed 2·5 to 3·5 per cent. infection. Columbia (a green variety) had 1·5 per cent. of the plants attacked. A recent selection (V.D. 30) from Golden Self Blanching (also made at Michigan) was completely resistant and appears to be a promising strain.

**Botany.**—*Forty-fifth Ann. Rept. Georgia Exper. Stat. for the year 1932*, pp. 34–36, 1933.

The following items of phytopathological interest occur in this report. Pimento pepper [*Capsicum annuum*] was attacked with unusual severity during the period under review both by 'ripe rot' (*Vermicularia* [*Colletotrichum*] *capsici*) [*R.A.M.*, xi, p. 804] and anthracnose [*C.* sp.: ibid., ix, p. 436]. Difficulty was experienced in the selection of seed stock free from both diseases, neither of which is amenable to seed treatment.

Groundnuts are subject to infection by two species of *Cercospora* causing leaf spot [cf. ibid., xi, p. 20]. The common practice of planting seed without shelling should be discontinued, since it has been found that a much higher percentage of germination may be obtained from shelled seed, disinfection of which, moreover, is scarcely necessary. Together with southern blight (*Sclerotium rolfsii*) [ibid., xi, p. 621], the leaf spots may reduce the groundnut yield by 50 per cent. Resistance to both diseases exists in some varieties but without the qualities necessary for successful

commercial cultivation. Resistance to leaf spot appears to be inherited as a unit character not linked with any other visible feature, so that it should be possible to combine this character with desirable commercial ones.

The highest yield of marketable cantaloupe melons was obtained from plots sprayed against downy mildew [*Pseudoperonospora cubensis*: ibid., xii, p. 5] with a weak Bordeaux mixture, the increase over the untreated controls being 9·6 crates per acre. The corresponding increases from Oxo-Bordeaux [ibid., xii, p. 240] and 3–4–50 Bordeaux were 6·1 and 4·2 crates per acre, respectively, while high lime Bordeaux (3–9–50) and 1–3–50 copper acetate sprays reduced the yields by spray injury.

LEVINE (M.). **Crown gall on Sahuaro (Carnegiea gigantea).**—*Bull. Torrey Bot. Club*, lx, 1, pp. 9–15, 2 pl., 1933.

No definite evidence has hitherto been available that the Cactaceae are liable to infection by the crown gall organism (*Bacterium tumefaciens*). In 1931 inoculation experiments were carried out on the side ridges of five- to six-year-old sahuaro (*Carnegiea gigantea*) plants from Arizona. The first reaction to inoculation is the formation of a small blackened area round the needle pricks, apparently due to the death of the severely injured cells. The development of tumour tissue is of lengthy duration compared with the reaction of the plants commonly used in experimental studies of crown gall. In *C. gigantea* necrosis persists for over a month and is followed by the formation of smooth, sessile or short-stalked tumours resembling those on beet [*R.A.M.*, x, p. 779] and bearing on one side a large number of densely-set areoles with numerous spines comparable to the leafy shoots frequently associated with tobacco galls and sometimes with those of Jimson weed [*Datura stramonium*] and geranium [cf. ibid., xii, pp. 59, 148]. The tumour tissue remains soft and is composed of parenchymatous cells interspersed with numerous areas of more actively growing, undifferentiated cells. Whorls of cells consisting of protoxylem with well-formed tracheids are abundant in galls sectioned eleven months after inoculation. The outer layers of the gall are composed of small embryonic cells with no trace of an epidermis or palisade tissue.

In similar inoculations on *Opuntia* spp. only necrotic areas developed.

LEDINGHAM (G. A.). **Life-history, morphology, and cytology of Polymyxa graminis.**—Abs. in *Phytopath.*, xxiii, 1, p. 20, 1933.

Marquis wheat seedlings growing in Ontario soil at Toronto were attacked in 1930 by a fungus with large, irregular, septate zoosporangia surrounded by a well-defined membrane and liberating numerous biciliate zoospores through exit tubes. The resting sori are round to elongated and often arranged in lines in the host cells. The multinucleate thalli segment to form spore balls. Two types of nuclear division occur in the development both of the zoosporangia and the resting spores, protomitosis coinciding with the growth of the thallus while mitosis accompanies segmentation. The character of the resting sori and the occurrence of protomitosis

in the growth of the thalli denote relationship with the Plasmodiophorales, while the well-developed zoosporangia point to an affinity with the Chytridiales. The fungus (an obligate parasite) is named *Polymyxa graminis* n.g., n. sp.

SCHEIBE (A.). **Die Schwarzrostepidemie auf dem Balkan 1932.** [The black rust epidemic in the Balkans 1932.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xiii, 1, pp. 5–6, 1933.

During 1932 the black rust (*Puccinia graminis*) epidemic among the cereal (especially wheat) crops of the Balkans attained an almost unparalleled severity [*R.A.M.*, xii, p. 150]. In Hungary the anticipated wheat harvest of 18,000,000 doppelzentner was reduced to 14,500,000 owing to the combined effects of rust and abnormal weather conditions (heavy rain at the end of June followed by cloudless days of tropical heat). According to Prof. B. Husz of Budapest, *P. graminis* is annually responsible for heavier damage to the Hungarian wheat crop than *P. glumarum*. In 1932 *P. triticina*, which is usually severe, caused smaller losses than *P. graminis*.

In Jugo-Slavia black rust was also prevalent, especially in the districts along the Hungarian frontier. In the cooler and damper western regions, *P. glumarum* was more in evidence. Rumania and Bulgaria both suffered heavy losses from *P. graminis*, while in the latter country *P. triticina* was also partially responsible for the immense reduction of yield (up to 90 per cent.) along the Danube. In Turkish Thrace and Macedonia, where black rust epidemics are virtually of annual occurrence, the damage was mainly limited to the late varieties. Extensive losses are further reported from southern Poland.

The source of primary infection by *P. graminis* in the 1932 epidemic has not yet been ascertained. There are still large areas in the Balkans where barberries flourish, and the observations of Bulgarian phytopathologists also point to an annual introduction of infective material from the south.

TIEMANN. **Kurze Betrachtung zum Rostbefall des Weizens in Schlesien im Jahre 1932.** [A short survey of the rust attack on Wheat in Silesia in the year 1932.]—*Mitt. Deutsch. Landw.-Gesellsch.*, xlviii, 1, pp. 7–8, 1933.

In the middle of July, 1932, the Silesian wheat crops were heavily attacked by black rust (*Puccinia graminis*) [*R.A.M.*, xii, p. 149]. The mean relative humidity for the month at Tschechnitz, near Breslau, was 88 per cent., an excess of 12 and 10 per cent. over the corresponding periods in 1931 and 1930, respectively. On several occasions, especially from 20th to 22nd, the relative humidity reached 100 per cent., the weather was sultry, with heavy showers at intervals, very cool nights, and extensive dew formation—all factors contributing to the spread of the disease. It was again observed that wheat following clover or other legumes is much more liable to black rust than when it succeeds beets. Some general directions are given for the reduction of infection by suitable cultural practices, and attention is drawn to

the work now in progress by experts on the breeding of rust-resistant varieties.

Peklo (J.). **L'état actuel de la lutte contre les rouilles chez les céréales en Tchécoslovaquie.** [The present state of the control of cereal rusts in Czecho-Slovakia.]—*Deuxième Congr. Internat. de Path. Comp.*, Paris, II, *Comptes rendus et Communications*, pp. 501–506, 1932.

After referring to the heavy losses caused by yellow rust of wheat (*Puccinia glumarum*) in Czecho-Slovakia [*R.A.M.*, iii, p. 209; vi, pp. 213, 345], the author states that in 1913 he began to cross hard, susceptible varieties with soft, resistant ones, using, among others, Kubanka, several winter wheats from the Hungarian-Slovakian region, and some Svalöf autumn wheats among which were varieties very resistant to yellow rust. From crosses so made between strongly and weakly resistant, and between two moderately resistant varieties, segregations were obtained which showed high resistance to *P. glumarum* in addition to heavy yield, resistance to lodging, and other desirable qualities. Evidence was obtained that, as regards lines almost but not quite homozygous for resistance, when resistance though very strong initially became slightly reduced in the first generations, there might be a severe development of rust in the following generations. Owing to the few genetic factors conditioning resistance, a very slight lack of original resistance could, through secondary segregations ('Nebenspaltungen'), conduce in the next two or three generations to a very pronounced want of resistance.

During the first ten years valuable segregations were obtained, including lines from a series in which the parents were a Czech 'alternative' wheat and a Svalöf autumn wheat and lines from another series of crosses between Kubanka and another Svalöf autumn wheat. The best lines from the two series were then combined so that the resultant hybrids had the Czech alternative wheat and Kubanka as grain quality parents and both Svalöf autumn wheats as high yielding parents. The first generations of the new hybrids showed better qualities than either series of parents; their development was vigorous, rust resistance strongly marked, and the grain was red, hard, and fine and weighed 80 kg. or more per hectol. In 1931 the yield was 32 quintals per hect. in large-scale tests.

Peltier (G. L.). **Relation of weather to the prevalence of Wheat stem rust in Nebraska.**—*Journ. Agric. Res.*, xlvi, 1, pp. 59–73, 1933.

Continuing his studies of the epidemiology of wheat stem rust (*Puccinia graminis tritici*) in Nebraska [*R.A.M.*, vii, p. 623], the author states that an examination of the time of heading and length of the ripening period of wheat during 28 consecutive years showed that in the eastern part of the State epidemics of black rust did not occur when winter wheat headed prior to, or in the first week of June, and matured before the first of July. In years when the fruiting period was prolonged, incipient epidemics were frequently checked by local ecological factors, among which low

temperatures are apparently a major limiting factor in the initiation of primary infection and in the subsequent development of the first uredosori, while the lack of an even distribution of relatively high precipitation is the major inhibiting factor in the development of subsequent generations of uredospores.

As indicated by a study from 1921 to 1930 of a number of factors influencing the development of the rust, an epidemic in the winter wheat area of Nebraska only occurs when a large amount of primary inoculum reaches the crop (mainly from overwintered uredospores from Texas successively multiplied as they travel northward) under conditions which favour maximum infection and development of primary uredosori, in years when the wheat enters the heading stage during the first week of June or later, the primary uredosori appearing at about the same time, and when there is an extended fruiting period during which optimum temperature, evenly distributed precipitation above the normal, and other favourable conditions promote the rapid development of the subsequent uredospore generations.

MACINDOE (S. L.). **Leaf rust of Wheat.**—*Agric. Gaz. New South Wales*, xliv, 1, pp. 35–39, 1933.

Throughout the Australian wheat belt, stem rust (*Puccinia graminis tritici*) is a much more important factor in reducing yield than is leaf rust (*P. triticina*) [*R.A.M.*, xi, p. 629], but the latter, by considerably reducing the water economy of the plant and rendering it less capable of taking full advantage of the available soil moisture, may depress the yield to a degree quite out of proportion to the apparent amount of infection. Leaf rust also accentuates moisture deficiency in a dry spring and therefore may account for much of the injury usually attributed to drought.

A list is given (arranged according to degree of resistance or susceptibility to leaf rust) of numerous wheat varieties grown for one to three years in experimental plots in New South Wales. A large group entirely free from leaf rust, while it includes none of economic value under local conditions, does, however, include Hope, some Marquis-Vernal emmer crosses from South Dakota (C. 5085, C. 5089, C. 5090, and C. 5084), and a Vernal emmer-Jumillo cross (C. 5083) from the same locality which are also highly resistant to stem rust.

Among many wheat varieties showing only a trace of leaf rust were durum wheats from different countries and very late maturing *vulgare* wheats mostly of European origin. Of these the only one of agronomic worth was the Farrer variety Thew, now seldom grown in Australia. None of the varieties showing light infection (10 per cent.) are recommended for commercial planting in New South Wales. Moderate infection (25 per cent.) was shown by the New South Wales wheats Burrill, Canimbla, Cedar, Clarendon, Florence, Firbank, Genoa, Jonathan, and Warren; by the Victorian wheats Cowman, Cowhort, Fedtal, Flamen, Minflor, Wardfir, and Whillan; by the Western Australian wheats Geeralying, Nabawa, and Sutton; and by Pusa 4, which is grown widely in Queensland and to some extent in New South Wales.

ALLEN (RUTH F.). **Heterothallism in Puccinia graminis, P. coronata, and Melampsora lini.**—Abs. in *Phytopath.*, xxiii, 1, p. 4, 1933.

The observations on heterothallism in *Puccinia graminis* and *P. coronata* [*P. lolii*] in this abstract have already been noticed from other sources [*R.A.M.*, x, p. 168; xii, p. 164].

Flax rust (*Melampsora lini*) has also been found to be heterothallic. The isolated unisexual infection bears no aecidiospores. Fertilization may occur in 8- to 20-day old infections, rarely older. Cells of the gametophytic, vegetative mycelium contain one to four nuclei. The young spermogonium centres on a stoma and at first uses the stomatal aperture as an ostiole. At this time no hyphae reach the leaf surface except at spermogonia. Cell fusions occur regularly in the aecidium.

MAINS (E. B.). **Host specialization of Erysiphe graminis tritici.**—*Proc. Nat. Acad. Sci.*, xix, 1, pp. 49–53, 1933.

Most of the varieties of *Triticum vulgare* wheats tested in 1924, 1929, and 1930 at Purdue University, Indiana, and in 1931 at Michigan University for reaction to physiologic form 1 of *Erysiphe graminis tritici* [*R.A.M.*, xii, p. 78] proved to be susceptible. Among them may be mentioned Fulcaster, Harvest Queen, Illini Chief, Kanred, Marquis, Minhardi, Turkey, and Velvet Chaff. A high degree of resistance, however, was shown by Axminister (C. I. 1839), Chul (C. I. 2277), Dixon (C. I. 6295), Erivan (C. I. 2397), Huron (C. I. 3315), Norka (C. I. 4377), and several selections of Illinois No. 1 (35, 47, and 59). Michigan Amber and a few other varieties showed marked fluctuations in their reaction to the fungus, being susceptible in some tests and resistant in others.

The club wheats (*T. compactum*) were mostly very susceptible, but one unnamed strain (No. 830) was very resistant in 1929, and three moderately so.

Most of the spelts (*T. spelta*) and durums (*T. durum*) were susceptible, among the latter being Acme, Arnautka, Kubanka, Mindum, Monad, and Pentad. Susceptibility also characterized most of the poulards (*T. turgidum*), except No. 820, and the Polish wheats (*T. polonicum*).

On the other hand, pronounced resistance was exhibited by most of the emmers, e.g., Khapli (C. I. 4013), Vernal (C. I. 1524), White Spring (S. D. 293), and Yaroslav (C. I. 1526), and also by the einkorns (*T. monococcum*), *T. dicoccoides*, *T. persicum*, and *T. timophevii*, while *T. stramineum* gave variable results. A number of wild grasses also proved very resistant, including *Agrostis alba*, *Agropyron repens*, *Arrhenatherum elatius*, *Bromus* spp. (7), *Festuca elatior* and *F. rubra*, *Elymus canadensis*, *Hordeum jubatum*, and *H. murinum*.

Physiologic form 2, isolated near Ann Arbor in the winter of 1932, causes heavy infection on Axminister and Norka, which are resistant to form 1. Most of the other 300 wheats inoculated with form 2 showed similar reactions to those obtained with form 1. Rye was apparently immune from this form.

FARIS (J. A.). **Influence of soil moisture and soil temperature on infection of Wheat by Urocystis tritici.**—Abs. in *Phytopath.*, xxiii, 1, pp. 10–11, 1933.

In inoculation experiments under controlled conditions with flag smut (*Urocystis tritici*) spores on Harvest Queen wheat [*R.A.M.*, ix, p. 167], a high percentage of infection was secured between 10° and 20° C. with fairly dry soil during the germination of the wheat. With a soil moisture of 40 per cent. (the best for sowing wheat), high infection occurred only when the seed-grain was germinated at a temperature of 10° to 15°. With a soil moisture approaching saturation (60 per cent.), extensive infection occurred at 10° while above or below this point there was a rapid drop in the percentages.

CHEN (H. K.), HWANG (L.), & YU (T. F.). **Experiments in controlling flag smut of Wheat.** [? Reprinted from *Nanking Journ.*, ii, pp. 401–414, 2 figs., 1932. Chinese, with English summary.]

Flag smut of wheat [*Urocystis tritici*] is stated to be particularly injurious in the vicinity of Nanking [*R.A.M.*, xi, p. 290], where the seedlings generally become infected either by spores on the seed or by those in the soil. Adequate control of the disease was given by höchst, uspulun, and tillantin B dusts [ibid., x, p. 371], none of which, however, completely eliminated infection. Several native and foreign varieties have been found to show a high degree of resistance to flag smut, verging on immunity, and their development is recommended as the most practical and efficient method of control. Crop rotation should be combined with seed treatment in order to remove one of the chief sources of infection, namely, the smut spores remaining in the field.

MEAD (H. W.). **Studies of methods for the isolation of fungi from Wheat roots and kernels.**—*Scient. Agric.*, xiii, 5, pp. 304–312, 1 pl., 5 graphs, 1933. [French summary on p. 345.]

Brief details are given of sixteen methods which were tested by the author for the surface sterilization of wheat roots and grains for the purpose of isolating organisms present within the tissues. The most consistently good results were obtained by Simmond's 'washer' method [*R.A.M.*, x, p. 257], which also permitted the handling of large quantities of material. In some cases saponin solutions and alcohol were used to wet the material prior to washing, and while alcohol usually somewhat reduced the growth of the fungi isolated, the saponin solutions for the most part encouraged their growth. Soaking in hydrogen peroxide for 20 minutes, followed by rinsing in sterile water, gave a good growth of the fungi from roots and grains, but the original strength of the solution was difficult to maintain. The same length of treatment in freshly made calcium hypochlorite solution was satisfactory with roots, but was not long enough to give complete surface sterilization of the grain. Mercuric chloride in water or alcohol was somewhat toxic to both the external and internal fungi of roots and grains, but gave effective sterilization of the latter, and did not injure their viability. One-hundredth normal silver nitrate

solution was found to be of no use for the purpose of isolation, but it proved very satisfactory for the preparation of sterile wheat seedlings.

FRASER (W. P.) & LEDINGHAM (G. A.). **Studies of the crown rust, Puccinia coronata Corda.**—*Scient. Agric.*, xiii, 5, pp. 313–323, 1 pl., 1933. [French summary on p. 345.]

As a result of their investigation of the occurrence of crown rust (*Puccinia coronata*) [*P. lolii*] in the prairie provinces of Canada and of extensive cross-inoculation experiments [the results of which are presented in eight tables] from 1925 to 1927, inclusive, the authors distinguish four different varieties of the fungus, namely, *avenae* with its aecidial stage on *Rhamnus cathartica*, and uredo and teleuto stages on cultivated species of oats and on *Avena fatua*; *calamagrostis* with its various stages on *R. alnifolia*, and on species of *Calamagrostis* and *Scolochloa festucacea*, respectively; *bromi* with aecidia on *Lepargyraea canadensis*, and the other stages chiefly on *Bromus ciliatus*, *B. latiglumis*, and *B. porteri*; and *elaeagni* on *Elaeagnus commutata* and a form or variety of *C. elongata*, respectively. The differentiation of these four varieties rests chiefly on the relationship of the aecidial hosts and on some morphological characters of the aecidia, while a statistical analysis of the size of the various types of spores showed no significant differences between them.

HOLBERT (J. R.), ELLIOTT (CHARLOTTE), & KOEHLER (B.). **Bacterial leaf blight of Dent Corn.**—Abs. in *Phytopath.*, xxiii, 1, pp. 15–16, 1933.

Bacterial leaf blight (wilt) of maize [*Aplanobacter stewarti*: *R.A.M.*, xii, p. 281] caused a loss of green leaf area, directly traceable to local bacterial infection, of up to over 50 per cent., with an average of 16·6 per cent., in the 66 fields surveyed in Illinois in 1932. The general appearance of the affected plants in the middle of August in some cases recalled that due to severe heat and drought. In most of the isolations the causal organism present in the leaf lesions did not occur in the same leaf veins farther down the lamina or in the sheath or bundles of the stalk below the infected leaf. Differences in strains of the pathogen were noted. The reduction in leaf area apparently increased susceptibility to stalk rot (*Diplodia*) [*zeae*] and chilling injury, besides decreasing the breaking resistance of stalks and total yield and quality of grain. Marked differences in reaction to wilt were shown by the various inbred strains and their crosses.

IVANOFF (S. S.). **Bacterial wilt of Corn.**—Abs. in *Phytopath.*, xxiii, 1, p. 18, 1933.

The western maize root worm (the larval stage of *Diabrotica longicornis*) has been found to act as a vector of Stewart's wilt disease of maize (*Aplanobacter stewarti*) [see preceding abstract]. After feeding on the roots of diseased plants, the larvae repeatedly transmitted infection when placed on the roots of healthy plants in the greenhouse. Several bacteria differing in various respects from *A. stewarti* were isolated from wilted plants. Inoculations

with these organisms on yellow Dent and sweet maize caused symptoms of varying severity in individual plants and produced different percentages of disease.

HOOVER (M. M.). **Inheritance studies of the reaction of selfed lines of Maize to smut (Ustilago zeae).**—*West Virginia Agric. Exper. Stat. Bull.* 253, 32 pp., 1932.

A fully detailed and tabulated account is given of the writer's studies, covering a period of ten years in West Virginia, on the factors governing the inheritance of smut (*Ustilago zeae*) in over 200 selfed lines of maize [*R.A.M.*, xii, p. 88] grown under conditions favouring epidemics of the disease.

Crosses between selfed lines of maize characterized by well-marked differences in regard to the place and amount of smut infection showed clearly that reaction to *U. zeae* is a host strain peculiarity transmissible from parent to offspring. Crosses between West Virginia selfed lines and certain 'linkage testers' (representatives of different genetic groups as classified by R. A. Emerson) indicated that at least four testers show a linkage relation with smut susceptibility. Thus, in group IV, characterized by the absence of ligules round the main stalk, most of the infection was found in the basal regions of the plant. The brachytic factor in group VI causes a marked shortening of the internodes; when the ear shoots appear the leaf sheaths are ruptured and afford a good focus for the infection of the inner meristematic tissue. Most of the plants in this group were attacked on or below the ear. The 'ramosa' group (VII) shows excessive branching of the ear, which causes the rupture of the protective husks and exposes the young spikelets. In over 95 per cent. of the plants comprising this group smut occurred in the ear. The 'ramosa' type plants obtained from the yellow and white resistant West Virginia strains crossed with members of the 'ramosa' group showed 93·6 and 82·1 per cent. infection, respectively, indicating that, at any rate in this cross, the gross morphology of the plant is a more important factor in smut reaction than parental resistance on one side. Group VIII was represented by the virescent #2 tester and by certain plants of the 'brevis' type, characterized by partial curtailment of the internodes. The $F_1$ plants as well as the back cross and $F_2$ progeny of the virescent #2 tester showed marked resistance to smut, possibly correlated with late maturity and general weakness. On the other hand, the 'brevis' progeny showed a high degree of susceptibility, correlated with the exposure of the tissues through the twisting of the culms and rupture of the leaf sheaths. The progeny of crosses between the crinkly dwarf 1-tassel seed #4 tester (group IX) and the susceptible local 'base' strain showed nearly 100 per cent. infection, due to the exposure of a mass of silks and seed in the tassel (a feature of the group) soon after emergence. Some decrease of infection (though the incidence remained high) resulted from the crossing of this 'tester' with the resistant West Virginia strains. The $F_3$ generation of a cross between the yellow and white resistant local strains is composed of a highly resistant population showing considerable promise as foundation stock for further breeding work.

It may be inferred from these data that reaction to *U. zeae* is conditioned by two sets of factors, one controlling the physiological behaviour and the other the morphological characters of the host plant.

EDDINS (A. H.) & VOORHEES (R. K.). **Physalospora on Corn and its taxonomic and host relationships.**—*Phytopath.*, xxiii, 1, pp. 63–72, 2 figs., 1933.

*Physalospora zeicola*, found on maize stalks in Florida producing an ear-rot similar to that caused by *Diplodia frumenti*, has been shown to be the perfect stage of the latter fungus [*R.A.M.*, x, p. 96; xi, p. 771]. Inoculation experiments on green maize stalks with the mycelium from pure ascospore cultures of *P. zeicola* resulted in a blackening of the pith and epidermis. Three of the five cultures formed the perfect stage on some stalks and the imperfect on others, while two developed the latter only; the perithecia, asci, and ascospores agreed with those of *P. zeicola*, and the pycnidia and pycnospores with those of *D. frumenti*. Similar tests on ears in the early milk stage resulted in the extensive rotting and blackening typical of infection by *D. frumenti*, both pycnidia and perithecia being formed.

The Florida form of *P. zeicola* is characterized by longer asci than the type species (95 to 140 by 10 to 13 compared with 75 to 80 by 12 to 15 $\mu$). The average dimensions of the pycnospores of the Florida fungus from artificially inoculated stalks and from culture were 25 to 27 by 12 to 13 and 26 to 28 by 13 to 14 $\mu$, respectively.

Since Stevens has shown that *P. rhodina* is the perfect stage of *D. natalensis* and *D. gossypina* [ibid., vi, p. 127], it would, in the authors' opinion, be less confusing to refer to this fungus by its perfect stage name than to call it *D. natalensis* on citrus and *D. gossypina* on cotton. The ascospores of *P. zeicola* are shorter and narrower than those of *P. rhodina* (13 to 27 by 6 to 11 $\mu$, mostly 20 to 23 by 8 to 9 $\mu$, as compared with 24 to 42 by 7 to 17 $\mu$, mostly 30 to 35 by 11 to 14 $\mu$). *P. zeae*, according to Stout [ibid., x, p. 305], differs from *P. zeicola* in its larger asci (85 to 150 by 13 to 22 $\mu$) and longer but narrow spores (19 to 25 by 6·5 to 8 $\mu$).

Inoculation experiments with *P. zeicola* showed that the fungus was most virulent on young ears. Under natural conditions maize ears are more liable to infection by *P. zeicola* at the butt than at the tip.

*P. zeicola*, *P. rhodina*, and *D. tubericola* (which can cause similar symptoms on maize) [ibid., x, p. 96] grew and formed pycnidia on 31 plants inoculated in the branches, stems, or other parts with mycelium from pycnospore cultures of the three organisms. Among these hosts may be mentioned peach, fig, sweet potato, watermelon, *Ricinus communis*, avocado pear, cotton, *Carica papaya*, orange, grapefruit, and mango. These studies indicate the need for a reclassification of Saccardo's list of *Diplodia* species, since it may be that many others of similar morphological relationships will have the same host range.

AJREKAR (S. L.) & LIKHITE (V. N.). **Observations on Tolyposporium penicillariae Bref. (the Bajri smut fungus.)**—*Current Science*, i, 7, p. 215, 1933.

The authors state that studies carried out at Ahmedabad and Baroda on *Tolyposporium penicillariae* [*Ustilago penniseti*: *R.A.M.*, x, p. 625], the causal organism of smut on bajri (*Pennisetum typhoideum*) in Gujarat, show that the fungus is readily cultivable by sowing spore balls on maize, *P. typhoideum*, or jowar [sorghum] meal agar, and on boiled potato or carrot. The growth on these media consists almost entirely of budding sporidia.

Infection takes place, as in wheat, at the flowering stage of the host, but no dormant mycelium is formed in the grains by *U. penniseti*, infection being followed about a fortnight after inoculation by spore-ball production. The fungus occupies the space between the pericarp and the aleurone layer of the grain, and forms its spore balls after gradually exhausting the starchy endosperm. In the early stages of infection the grains contain a characteristic white mycelium. No resting period is required for the germination of the spore balls, at any rate on artificial media; natural germination of these organs has not been observed. *U. penniseti* is not amenable to control by seed treatment with copper sulphate, and none of the common varieties of *P. typhoideum* is immune from the disease.

HUNGERFORD (C. W.) & REMSBERG (RUTH). **Sclerotium diseases of grains and grasses.**—Abs. in *Phytopath.*, xxiii, 1, p. 17, 1933.

Fourteen cultures were obtained of sclerotial fungi of widespread occurrence on grains and grasses in the mountainous regions of Idaho. The optimum temperature for the organisms, which appear after the snow melts, ranges from 0° to 10° C. One of the four groups to which the fungi under observation have been assigned corresponds to a culture of *Typhula graminum* supplied by H. Tasugi from Japan [*R.A.M.*, ix, p. 709]. The pathogenicity of several of the organisms was demonstrated by laboratory and field tests. Late sowing and the use of resistant varieties appear to be effective against *T. graminum*.

GUISCAFRÉ (J. R.). **The brown rot fungus in Puerto Rico.**—*Journ. Dept. Agric. Puerto Rico*, xvi, 2, pp. 193–202, 2 pl. 1932. [Received April, 1933.]

In giving a brief account of brown rot gummosis (*Phytophthora citrophthora*) of citrus trees [*R.A.M.*, xii, p. 89], the author states that in Porto Rico the disease was recorded for the first time in 1931 in citrus groves at the Eugenia plantation, near the town of Añasco. A survey has shown that many areas there are seriously affected, while in others the young trees that were planted to replace dead ones are also diseased and produce coarse, discoloured, sour or insipid fruit, unfit for the market. It is pointed out that in the plantation conditions are very favourable for the development of the disease; the annual rainfall is from 70 to 80 inches, the water table is often found at 1 to 1½ feet below the surface, and the trees are budded low.

Fawcett (H. S.). **Prevention of brown rot gummosis on young Citrus trees.**—*California Citrograph*, xviii, 3, p. 84, 1933.

After pointing out that under Californian conditions it is impossible in practice to separate the brown rot gummosis of citrus caused by *Phytophthora citrophthora* [*R.A.M.*, xi, p. 212 and preceding abstract] from that caused by *P. parasitica*, the author states that common lemon and sweet orange are both susceptible, the latter, however, much less so, as a rule, than the former. Rough lemon and sour orange [*Citrus aurantium* var. *bigaradia*] under most conditions are almost immune [cf. ibid., x, p. 98]. As the present tendency is to use more sweet orange stock in new plantings, prevention, especially on young trees, calls for all the more attention.

The most critical period appears to be the first year in the orchard, when it is difficult in California to start newly set trees without running water next to the trunks. The trees should be planted at such a height that after settling they are at least as high as they were in the nursery. In using any susceptible rootstock the bark at the base down to the first main roots should be protected with Bordeaux paste, spray, or powder, about one-fifth of an ounce of the last-named being shaken on to the trunk and round it to a diameter of two or three inches just after planting and before the first irrigation. As the trees grow older the amount of Bordeaux powder used may be gradually increased until one ounce or more is used on trees not under ten years old. As soon as possible during the second year and after, growers should begin to keep the water away from the trunks.

The paper concludes with a brief description of the usual Californian treatment for affected trees. Once young trees are affected, whether or not treatment will prove worth while depends entirely upon the severity of the infection.

Reichert (I.). **A new root rot of Citrus trees in Palestine.**—Reprinted from *Hadar*, v, 11, 8 pp., 3 figs., 1932.

Citrus trees in Samaria, Palestine, were attacked in 1931 by a root rot associated with a fungus of uncertain identity which caused a yellowing, wilting, and eventual desiccation of the leaves, dying-back of the branches, and a white rot of the roots and collar. White and brownish hyphae were found in the bark, wood, and pith of the roots, and a whitish mat of mycelium with fan-like margins covered their surface. On potato agar the mycelium was composed of hyphae measuring 1 to 4 $\mu$ in diameter and bearing spherical or irregular chlamydospores; clamp-connexions were also observed.

Certain features of this organism agree with *Armillaria mellea*, but the absence of rhizomorphs and the chlamydospore formation are against this suggestion. The latter are reminiscent of those produced by the 'phthiriose' organism of Mangin and Viala, regarded by the author as a *Polyporus*.

The affected trees were two years old and only those budded on sweet lemon were diseased. Oak and eucalyptus props supporting the trees were also infected, though to a lesser extent than the chestnut props.

Recommendations are given for the eradication of the diseased trees and trenching the infected sites.

CHAUDHURI (H.) & SINGH (G.). **The wither-tip disease of Citrus plants. Part I.**—*Journ. & Proc., Asiatic Soc. of Bengal* (N.S.), xxvi, 4, pp. 523–532, 3 pl. (1 col.), 1933.

Nearly all kinds of citrus throughout India have been found by the writers liable to infection by *Colletotrichum gloeosporioides*, the causal organism of wither-tip [*R.A.M.*, ix, p. 64]. In Lahore the fungus was observed on the lime, lemon, pomelo, and on the Malta orange, mostly confined to the twigs, though the leaves were occasionally affected. Nursery plants in the Lawrence Gardens showed the first symptoms of infection early in February, when the newly attacked apical portions lost their leaves and assumed an ashen tint; black acervuli developed later on the affected areas. The disease was more severe on lemons and sour limes than on oranges (including the Malta) and sweet limes. Recently a number of cases were observed in which immature and young fruits dropped as a result of infection by *C. gloeosporioides*. The twigs are often killed back four or five inches, and older branches may also suffer from the attacks of the parasite.

The wither-tip fungus was isolated from a Malta orange twig collected in October, 1928. The mean length of the spores in culture ranged from 12·2 on Czapek's medium to 15·8 $\mu$ on prune agar, and the mean breadth from 2·2 to 5·7 $\mu$ (maize and potato glucose, respectively). On the host the average size of the spores is 12·9 by 5·7 (extremes 8·5 to 21 by 3 to 7·5 $\mu$) and there is a considerable variation both in size and shape even in the same acervulus. The spore dimensions were found to decrease from lower to higher concentrations of Czapek's medium. The temperature range for the growth of the fungus was found to extend from 15° to 35°, with an optimum between 21° and 25° C. The thermal death point lies between 65° and 66° (ten minutes' exposure). Of a large number of isolations, only three showed slight differences in spore dimensions and might possibly be distinct strains; two were isolated from *Citrus acida* [*C. medica* var.] and one from lemon. In numerous cross-inoculation tests each strain infected all the other hosts.

In laboratory inoculation experiments, the young, tender parts were first attacked. In 1929 heavy losses occurred among citrus plants in the Punjab owing to the intense cold of late January and early February, which so weakened the tissues that *C. gloeosporioides* readily gained entrance; all the seedlings in the Lawrence Gardens were thus killed.

REGUERAL (F. G.). **La foliocelosis o veteado de las hojas del Naranjo.** [The foliocellosis or mottling of Orange leaves.]—*Bol. Pat. Veg. y Ent. Agric.*, vi (*1931*), 23–26, pp. 58–68, 4 figs., 1932.

An account is given of the disturbance known as foliocellosis or mottling of orange leaves [*R.A.M.*, xi, p. 26], which is stated to be prevalent in Valencia, Spain. The condition is characterized by chlorosis of the secondary veins, elongation of the leaves, and

general stunting of the branches. The so-called 'media puncha' ['half thorn'] variety seems to be particularly susceptible to foliocellosis, while the 'vernia' is more resistant, and Washington Navel shows the effects comparatively little owing to its vigorous and luxuriant habit of growth. A considerable reduction of yield may result from foliocellosis. Most of the Valencian soils are deficient in lime, containing only 4 to 6 or even as little as 0·5 per cent., and the application of calcium is therefore recommended (calcium carbonate or lime at the rate of 10,000 kg. per hect. for the former and 4,000 to 5,000 kg. for the latter every 5 to 6 years, or 1,000 kg. gypsum every 3 years).

HESSELTINE (H. C.). **Diabetic or mycotic vulvovaginitis. Preliminary report.**—*Journ. Amer. Med. Assoc.*, c, 3, pp. 177–178, 1933.

Evidence is presented showing that yeasts (including *Saccharomyces*, *Cryptococcus*, *Endomyces*, and *Monilia* spp.) are etiologically associated with the development of vulvovaginitis in diabetic patients [cf. *R.A.M.*, ix, p. 311]. *Endomyces* was the most frequent in the restricted series of cases examined.

WILSON (S. J.), HULSEY (S.), & WEIDMAN (F. D.). **Chromoblastomycosis in Texas.**—*Arch. of Dermatol.*, xxvii, 1, pp. 107–122, 5 figs., 1933.

An account is given of an extensive verrucosis of the leg, of forty years' duration, in a Texas farmer. The fungus isolated from the lesions was identified as *Phialophora verrucosa* [*R.A.M.*, xi, p. 645], of which there is stated to be only one other authenticated case in the literature (*Journ. Cutan. Dis.*, xxxiii, p. 840, 1915). It is characterized by a light brown, beaded mycelium with short segments up to 3 $\mu$ in diameter; lateral or terminal phialides measuring 8 by 2·5 $\mu$, generally surmounted by a minute empty cup but occasionally by a small conidium; and smooth, hyaline conidia, 2 to 2·5 by 1 to 1·5 $\mu$. A species of *Alternaria* was recovered from a rat inoculated with *P. verrucosa* and is believed to be genetically connected with the latter. The colonies of *P. verrucosa* on Sabouraud's agar are slaty to coal-black and very superficial. Some comparisons are drawn between the case under discussion and Gilchrist's blastomycosis [ibid., xi, p. 643].

ELLIS (D.). **The incidence of asthma in Port Sudan, with special reference to the influence of moulds.**—*Guy's Hospital Repts.*, lxxxiii, 1, pp. 102–111, 3 graphs, 1933.

Of the 50 cases of acute asthma investigated by the writer at Port Sudan, 43 developed the disease for the first time after coming to the town, indicating the existence of some asthmogenic factor in the locality. Climate was the first to be considered and it was ascertained that 44 of the patients suffered the most severe paroxysms in the winter. No correlation could be detected between the incidence of asthma and the factors of soil, vegetation, and dust.

On a damp December day ten Petri dishes were filled with a medium of agar and 10 per cent. glucose, sterilized, and exposed

to the atmosphere for nine hours, after which they were covered and five placed in the ice chest and five in the incubator. After three days well-developed colonies of *Aspergillus niger* and *Penicillium glaucum* were observed, 14 or 15 on each plate, those on ice being larger and growing more rapidly. When the experiments were repeated on a relatively dry, hot day in July, only one or two colonies were obtained among all the plates exposed.

A concentrated emulsion, prepared from living spores of *P. glaucum* (which was found to give more definite reactions than *A. niger*) was injected through epidermal scratches into two of the patients, each of whom developed violent asthmatic and local symptoms within half an hour. In subsequent tests one minim of the standardized mould-containing fluid was injected intradermally on the outer side of the right arm, one minim of the saline solution used for dilution being simultaneously injected into the outer side of the left arm. Numerous control experiments were similarly conducted on normal persons as well as on those suffering from various pathological conditions, none of whom developed positive reactions. All but two of the asthmatic patients, on the other hand, experienced more or less pronounced reactions. Attempts to isolate the fungus from the sputa gave negative results.

Treatment by a process of desensitization has been instituted in Port Sudan, and so far the outcome has been very satisfactory, both with English people and natives. The injections have been started with single minim doses of the standard suspension and gradually increased to ten minims, the latter dose being applied weekly until the attacks cease. No adverse effects have followed the use of live cultures, and the efficacy of dead ones has not yet been determined.

FALCHI (G.). **The action of chemical substances on mycetes causing dermatomycosis.**—*Boll. Soc. Ital. Biol. Sper.*, vii, pp. 1352–1357, 1932. (Italian.) [Abs. in *Chem. Abstracts*, xxvii, 6, pp. 1404–1405, 1933.]

The action of methyl violet, crystal violet, gentian violet, malachite green, methylene violet, and safranin on the cultural development of *Trichophyton*, *Achorion*, and *Microspóron* spp. was studied. Gentian violet and malachite green were the most effective in preventing growth, closely followed by methylene and crystal violet [*R.A.M.*, xi, p. 716]. *A. schoenleini* and *T. violaceum* were the most sensitive of the organisms tested.

JUNGHERR (E. L.). **Observations on a severe outbreak of mycosis in chicks.**—*Journ. Agric. Res.*, xlvi, 2, pp. 169–178, 3 figs., 2 graphs, 1933.

Details are given of a severe outbreak in 1931 of thrush in a commercial chicken hatchery in Connecticut, which out of a population of 50,000 killed 10,000 under the age of 60 days. The lesions, which are described and involved practically the whole of the digestive tract, on isolation yielded three yeast-like fungi resembling *Monilia* [*Candida*] *albicans* [*R.A.M.*, xii, p. 172], *M.* [*C.*] *krusei* [ibid., xi, p. 645], and *Oidium* [*Oospora*] *lactis* [ibid., xi, p. 743]. The symptoms of the disease were reproduced by feeding

the chickens' faecal material from diseased individuals, and by injecting cultures of the *C. albicans* type; only two cases of death resulted from injections with the *C. lactis* type of organism. There was circumstantial evidence that the disease is transmissible through the agency of the eggs, and it is presumably carried on the surface of the latter. As far as the author is aware, this is the first record of an outbreak of thrush of major epidemiological importance in chickens.

SAVAGE (A.) & ISA (J. M.). **A note on mycotic pneumonia of chickens.**—*Scient. Agric.*, xiii, 5, p. 341, 1 fig., 1933. [French summary on p. 346.]

The cause of an epidemic outbreak of pneumonia due to *Aspergillus fumigatus* [*R.A.M.*, xi, p. 715; xii, p. 271] which in 1932 killed over 90 per cent. of a brood of 400 chickens near Winnipeg, was traced to the heavy infection with the fungus of dry maize ensilage which had been used as litter for the chickens.

DE JONGE (L. J. A.). **Plantenziektenkundige vraagstukken in verband met de Vlascultuur.** [Phytopathological problems in connexion with Flax culture.]—*Tijdschr. over Plantenziekten*, xxxix, 1, pp. 1–10, 1933.

An account is given in general terms of the principal flax diseases and their geographical distribution in Holland and elsewhere, viz., wilt (*Fusarium lini*), canker (*Colletotrichum linicolum*) [*C. lini*: *R.A.M.*, xii, p. 220], *Botrytis* disease (*B. cinerea* f. *lini*) [ibid., ix, p. 246], scorch (*Pythium megalacanthum*) [ibid., xi, p. 578], and the *Phoma* disease (*P. exigua*) [ibid., xi, p. 25]. Attention is drawn to the great prevalence of rust (*Melampsora lini*) in the provinces of Groningen and Friesland and to its relative scarcity in Zeeland; the blue-flowering varieties are by no means rust-immune, as is often stated in the literature, though less susceptible than the white ones. The latter (represented by Texala, Bella, and Excello) also appear to be susceptible to *P. exigua*.

NELSON (C. I.). **A method for determining the specificity of the intracellular globulin of Fusarium lini.**—*Journ. Agric. Res.*, xlvi, 2, pp. 183–187, 1933.

After a brief description of two methods which were evolved for the extraction of protein material from mycelial masses of *Fusarium lini* [*R.A.M.*, xii, p. 220], the author gives a few details of experiments on rabbits which showed that a protein fraction corresponding to globulin possesses antigenic properties to a higher degree than ground masses of mycelium. There also was evidence that the latter retained antigenic specificity in proportion as the method used in crushing and extracting its juice failed to remove the globulin. It is thought that it may be possible on further refinement of the methods to use them for the purpose of determining by serological tests the interrelationships of the physiological strains of *F. lini* to which the varying reactions of resistant flax varieties in different localities have been attributed [ibid., vi, p. 294].

AGGÉRY (Mlle B.). **Sur une nouvelle espèce de Gloeosporium parasite du Scolopendre et sur sa biologie.** [On a new species of *Gloeosporium* parasitic on *Scolopendrium* and on its biology.]—*Comptes rendus Soc. de Biol.*, cxii, 3, pp. 258–260, 1933.

Leaves of the hart's-tongue fern, *Scolopendrium vulgare*, in the eastern Pyrenees and at the Toulouse Botanical Garden were observed in 1931 to bear circular, brown spots, 3 to 15 mm. in diameter, from which was isolated a species of *Gloeosporium* regarded as new and named *G. nicolai*.

The fungus [a Latin diagnosis of which is given] is characterized by intercellular, sparsely branched hyphae, 3 to 8 $\mu$ in width, penetration being effected by means of an infection hypha from a terminal appressorium. The hypophyllous acervuli are reddish, subcutaneous, 53·5 to 214 by 110 to 480 $\mu$, and the hyaline, oval, cylindrical, or piriform, simple, thick-walled conidia, 32 to 54 by 16 to 22 $\mu$, are extruded in a small, white, glistening cirrhus.

CURZI (M.). **Su una clorosi maculata della Rosa.** [On a spotted chlorosis of Rose.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 4, pp. 365–376, 1 pl., 2 figs., 1932.

Brunner roses growing in the open and under glass at San Remo, developed, shortly before flowering, a yellow leaf spot which later became very marked though the plants in all other respects remained normal. Grafting shoots from diseased roses on to healthy ones gave negative results, and affected roses removed to other soils did not show the spotting on the new growth. The soil on which the plants were growing had a $P_H$ value of 8·4 to 8·6 with a lime content of 32 per cent. A short distance away, where the soil had a $P_H$ value of 7·4 to 7·6 and a lime content of only 16 per cent., the same variety was quite healthy, as it was when grown in Rome in soil with a $P_H$ value of 7·2 to 8·2.

The condition is regarded as a chlorosis due to soil alkalinity, to which Brunner roses appear to be particularly susceptible, aggravated by heavy applications of nitrate of soda in the place of organic manure, and the high marl content of the subsoil.

A bibliography of 23 titles is appended.

VOGLINO (P.). **Ricerche sulla Fusariosi degli Astri della Cina.** [Researches on *Fusarium* wilt of China Asters.]—Reprinted from *Ann. R. Accad. Agric. Torino*, lxxv (*1932*), 22 pp., 2 pl., 8 figs., 1933.

Describing the results obtained in three years of study of the *Fusarium* wilt of China asters (*Callistephus chinensis*) which in recent years has become progressively worse in Italy, where it now causes very heavy losses [*R.A.M.*, x, p. 775; xi, p. 375], the author states that the morphological characters [which are described] of the causal organism agree with those of *F. conglutinans* var. *callistephi*. The fusoid, falcate, acute, hyaline conidia are never continuous but almost invariably 3-septate, measuring 28 to 35 by 4·5 to 5 $\mu$; very occasionally 4- to 5-septate conidia 50 $\mu$ long are produced. One of the most salient characters is the presence of

chlamydospores in chains. In culture these organs retained their germinative capacity for over a year. The fungus is thus distinct in its conidial characters from *F. conglutinans* var. *majus*, found on the stems of China asters in other countries [ibid., xii, p. 175]. It is also distinct from *F. conglutinans*, the cause of cabbage yellows, which has narrower conidia and no chains of chlamydospores. Inoculations of China asters, cabbages, and various other plants with pure cultures of *F. conglutinans* var. *callistephi* invariably gave positive results only on the first-named.

In Italy the disease becomes epidemic after transplanting and during flowering, when it is favoured by high temperatures; in cold weather it is less severe. Spread is due essentially to the abundant presence of chlamydospores in the soil, and is especially marked in those deficient in lime.

The early, European varieties, such as Penna di Struzzo, Queen of the Market, Comet Express, Hercules, and Unicum are susceptible, the late, American ones, known as Californica (Ramosa, Gigante, etc.) less so [cf. ibid., viii, p. 553; x, p. 227; xi, pp. 244, 302].

Preventive measures consist in disinfecting the soil (and liming copiously, if necessary) before planting, taking care not to injure the collar or roots during transplanting, immediately destroying affected plants, and spraying with 1 per cent. copper sulphate or 1 to 2 per cent. copper oxychloride. Asters must not be planted in soil already infested.

A bibliography of 14 titles is appended.

Creager (D. B.). **Fusarium basal rot of bulbous Iris.**—Abs. in *Phytopath.*, xxiii, 1, p. 7, 1933.

In the summer of 1929 the roots and bulbs of Spanish and Dutch irises on Long Island, New York, were found to be severely attacked by a species of *Fusarium* closely resembling *F. oxysporum*. The disease is very destructive to a number of commercial varieties, including Cajanus, Hart Nebrig, and Imperator. The fungus enters the roots and finally involves the basal plate and bulb scales. The inoculation of healthy bulbs with the fungus in moist chambers gave positive results, which also followed the planting of susceptible varieties in artificially infested soil.

Brierley (P.). **Virus diseases of Dahlia.**—Abs. in *Phytopath.*, xxiii, 1, p. 6, 1933.

Dahlia mosaic [*R.A.M.*, x, p. 83] is stated to be prevalent in New York, New Jersey, Connecticut, and probably throughout the United States. Veinbanding is the most typical symptom, while dwarfing, leaf distortion, and vein necrosis may or may not be present. The virus has been transmitted by grafting and by *Myzus persicae*, the incubation period usually ranging from four to six weeks.

Ring spot of dahlias is characterized by zig-zag or ring markings in green shades, later becoming necrotic. It is transmissible by grafting, usually in combination with mosaic, from which it is not certainly distinct. A yellow variety of the disturbance is known only from Utah; this virus, also transmissible by grafting,

produces symptoms distinct from mosaic on two varieties. An oak-leaf pattern, apparently of virus origin, differs from all the above-mentioned types on one variety and from mosaic on another.

BORNMÜLLER (J.). **Die Scharlachkrankheit der Mahonia, Uropyxis mirabilissima P. Magnus.** [The scarlet disease of *Mahonia, Uropyxis mirabilissima* P. Magnus.]—*Mitt. Deutsch. Dendrol. Gesellsch., 1932*, xliv (*Jahrb.*), pp. 290–291, 1932.

A popular account is given of the occurrence and methods of dissemination of *Uropyxis* [*Puccinia*] *mirabilissima* on *Mahonia* [*Berberis*] *aquifolium* in Germany [*R.A.M.*, xii, p. 293].

KEUR (J. Y.). **Seed transmission of the virus causing variegation of Abutilon.**—Abs. in *Phytopath.*, xxiii, 1, p. 20, 1933.

The virus producing variegation in *Abutilon thompsoni* and *A. mulleri* [*R.A.M.*, xi, p. 592] was found to be transmissible to a limited extent to some of the seedlings obtained by crossing these two clones. Out of 536 seedlings arising from this cross 287 were green and 249 showed 'variegated' characters, which could only be transmitted in four cases to susceptible *A. regnellii* scions by grafting.

SIBILIA (C.). **Uno scopazzo su 'Daphniphyllum macropodium'.** [A witches' broom on *Daphniphyllum macropodium.*]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 4, pp. 395–404, 2 figs., 1932.

A 30-year old *Daphniphyllum macropodium* tree in the Botanical Gardens, Rome, showed the presence of a large witches' broom at least five to six years old and 2·5 to 3 m. high by nearly 1 m. broad. The basal branch of the broom was swollen and contorted, with numerous, closely packed, thin, negatively geotropic branches. Three or four years after the original formation of the broom, the only abnormal growth consisted in swellings at certain nodes, from which emerged numerous, rather thin branches, plagiotropic near the trunk and negatively geotropic only towards the tip. The leaves appeared to be normal. The oldest branches of the broom were dead.

The necrosed parts of the broom (which could not have been caused by mechanical injury or insect attack) contained a mycelium which in culture was white, later greyish-green. The fructifications, which were not found in nature, consisted of yellowish-red masses of thin, short, compacted conidiophores bearing the hyaline, ovate-elongated conidia of a *Gloeosporium*, only one species of which, *G. kawakamii*, appears to have been previously reported to cause witches' brooms [*R.A.M.*, vi, p. 233].

The mycelium had at first spread along the main branch of the broom, after which the only signs of pathological activity were the swellings on the main axis and a few prematurely dead or sickly lateral branches. Mycelium was not found in the healthy lateral branches, but was present in those that were swollen; the fungus was obtained from the bark and wood, but not from the leaves.

The morphology of the galls [which is described] was very

closely similar to that of others of the same general type [cf. ibid., iii, p. 481; vi, p. 706; x, p. 764].

A bibliography of 19 titles is appended.

ROSEN (H. R.) & BLEECKER (W. L.). **Comparative serological and pathological investigations of the fire-blight organism and a pathogenic, fluorescent group of bacteria.**—*Journ. Agric. Res.*, xlvi, 2, pp. 95–119, 1 pl., 5 figs., 1933.

After a brief account of the senior author's discovery in Arkansas of a bacterial disease (termed 'blast' in this paper) simulating, but distinct from, fireblight (*Bacillus amylovorus*) of apple and pear trees [*R.A.M.*, xi, p. 160], a detailed description is given of comparative serological and pathogenicity studies of the causal organism isolated from pears, and of *B. amylovorus* [ibid., xii, p. 225], *Phytomonas* [*Pseudomonas*] *citriputeale* [ibid., xii, p. 281], *P. syringae* [ibid., xi, p. 379], and *P. prunicola* [ibid., xii, p. 227], all of which are fluorescent pathogenic organisms. The results of the investigation showed that while the pear 'blast' bacterium gave no indication of relationship to *B. amylovorus*, it exhibited very close kinship to *P. syringae, P. prunicola*, and *P. citriputeale* both in its serological reactions and in the nature of the lesions it caused on pear twigs and leaves with or without wounding, and also on oranges and lemons on which *B. amylovorus* produced no infections. Cross-agglutination tests, in particular, showed that the pear blast, lilac blight, plum wilt, and citrus blast organisms are so closely related as to be indistinguishable from each other. From the published accounts of *P. cerasi* [ibid., xi, p. 311], *P. papulans* [ibid., x, p. 604], *P. nectarophila, P. barkeri*, and *P. utiformica* [ibid., xi, p. 379] it is believed that these organisms are also doubtfully distinct from the foregoing. For the present the authors accept the name *P. syringae* for this group of fluorescent bacterial pathogens.

In a discussion of the various methods hitherto used in the differentiation of bacterial species, it is contended that no useful purpose is served in erecting new species on the basis of a few cultural and physiological differences or on assumed host relationships, while the remarkable correlation shown in the present studies between pathogenicity and serological reactions of the organisms clearly demonstrates the value of the latter in determining the relationships of bacterial plant pathogens [cf. ibid., xi, p. 700].

On apples and pears *P. syringae* causes early spring infection of unopened blossom buds and an intense blackish discoloration of tissues along and between the veins of the leaves. It is typically a cool weather disease, becoming less prevalent as warm weather sets in. Young pear fruits are also naturally attacked and in artificial inoculations tender twigs were blighted. The incubation period is shorter than that of fireblight.

FRICKHINGER (H. W.). **Der Lagerschorf und seine Bekämpfung.** [Storage scab and its control.]—*Die Kranke Pflanze*, x, 1, pp. 6–8, 1933.

A popular account is given of late scab [*Venturia inaequalis*]

of stored apples and its control, based on recent German and Swiss investigations all of which have been noticed in this *Review* [*R.A.M.*, x, pp. 526, 801; xii, p. 32].

BIRMINGHAM (W. A.). **Another fungus attacking Apple stocks.**—*Agric. Gaz. New South Wales*, xliv, 1, pp. 58–60, 2 figs., 1933.

In April, 1932, some 50 per cent. of the Northern Spy apple stocks in a nursery in New South Wales were killed by *Sclerotium rolfsii* [*R.A.M.*, iv, p. 69]. The trees were attacked in groups and the symptoms resembled those due to drought, the foliage dying but not falling immediately. Infection occurred ½ to 2½ in. below soil level. The disease appeared towards early summer, was most severe as autumn approached, and became quiescent when cold weather set in. Thirty-six of the stocks obtained from this nursery were worked to Willie Sharp scions in an orchard at Dural, of which sixteen died and ten others subsequently became infected, while of nine adjacent Northern Spy stocks raised from old trees in the orchard, six died. The latter probably became infected during hoeing.

It is recommended that, before planting, stocks should be washed to remove any superficial fungal growth, and steeped for ten minutes in 1 in 320 formalin. If the soil is infected, freshly slaked lime should be harrowed in at the rate of 1 ton per acre, this being followed by drenching with copper sulphate (1 lb. to 7 galls. of water), or with mercuric chloride (4 oz. to 50 galls. water) applied at the rate of 1 gall. per sq. ft., or with ammoniacal copper carbonate (1 gall. per sq. ft.), using 5 oz. copper carbonate and 3 pints of ordinary strong ammonia to 50 galls. water. Frequent cultivation to dry the top soil creates conditions unfavourable to the growth of the fungus.

SARDIÑA (J. R.). **Acerca de la 'podredumbre verde' de las Manzanas.** [Concerning the 'green rot' of Apples.]—*Bol. Pat. Veg. y Ent. Agric.* vi (*1931*), 23–26, pp. 44–50, 4 figs., 1932.

Attention is drawn to the recent detection, in the Madrid market, of numerous cases of green rot of apples caused by *Penicillium crustaceum* [*R.A.M.*, x, p. 253], two types of which are recognized, viz., one characterized by a vitreous, water-soaked condition with no obvious traumatism, and the other by a small wound in the centre of the lesion. In a preliminary test some degree of control was achieved by the application to the fruit, before inoculation, of Bordeaux mixture with casein as an adhesive (1 kg. copper, 1 kg. lime, and 50 gm. casein per 100 l. water).

DAS GUPTA (S. N.). **Studies in the genera Cytosporina, Phomopsis, and Diaporthe. III. On the pathogenicity of Cytosporina ludibunda, and its saltants.**—*Ann. of Botany*, xlvii, 185, pp. 197–226, 12 diags., 1933.

This is an account of the author's experiments from 1927 to 1929, inclusive, to test the rotting power on apples of certain of the saltants of *Cytosporina ludibunda* described in a previous communication [*R.A.M.*, ix, p. 547], as compared to that of the parent strain, the apple varieties used being Bramley's Seedling

and Worcester Pearmain. The rotting energy of the different strains was measured by the rate of radial advance of the fungus [ibid., vii, p. 585], and the results were tested by the usual statistical methods. Taken together, the evidence obtained indicated that the saltants may be conveniently divided into three groups, namely: I most active (more so than the parent), II moderately active, and III weak (comprising only one strain, $CC_2$), although under certain conditions the relative position in the groups of some saltants was interchanged. The rates of invasion varied considerably, the most active strain being from 20 to 50 times more active than the weakest ($CC_2$). It was further found that the rotting energy of the strains varied with the variety of apple and the age of the fruit, the indications being that the observed variations in the rate of radial advance were due to differences or changes in the resistance of the apples (probably conditions of chemical composition), rather than to modifications of the fungus. Some evidence also pointed to a differential effect of the season of growth of the apples (the 1928 season as compared with that of 1929) on the attacking power of the strains, but this point is not considered to have been conclusively established.

BERG (A.). **A fruit spot associated with the papular type of Apple measles.**—Abs. in *Phytopath.*, xxiii, 1, p. 4, 1933.

From several specimens of Grimes Golden apples at Purdue, Indiana, bearing numerous circular, nearly black fruit spots, a fungus was isolated agreeing in every respect with that causing the papular type of 'measles' on the wood [*Clasterosporium* sp.: *R.A.M.*, xi, p. 248]. Similar spots were produced by inoculation on the Rome variety, infection occurring through the lenticels.

BROOKS (C.). **Spoilage of stone fruits on the market.**—*U.S. Dept. of Agric. Circ.* 253, 11 pp., 2 figs., 4 graphs, 1933.

A study of the car-lot inspection certificates of the United States Bureau of Agricultural Economics for the period 1922 to 1928, inclusive, shows the spoilage of stone fruits in transit to be largely caused by decay due to *Rhizopus* [chiefly *nigricans*] and brown rot (*Sclerotinia fructicola*) [*S. americana*: *R.A.M.*, xii, pp. 102, 228]. In a total of 7,846 cars of peaches inspected during the seven years, 2,245 showed 5 per cent. or more of the fruit to be affected by brown rot, while *R. nigricans* or other types of soft rot (including *Penicillium*, *Botrytis* [*cinerea*], and *Fusarium*) was present on 5 per cent. or more of the fruit in 670 cars. During the period under review, 766 shipments of peaches arrived in the larger markets with either brown or *Rhizopus* rot in 20 per cent. or more of the fruit, 987 with 10 to 20 per cent. infection, 1,162 with 5 to 10 per cent., and 2,504 with 1 to 5 per cent. The annual loss of peaches on the market from the common forms of decay, based on these estimates alone (which represent less than 3 per cent. of the total yearly shipments), is about $200,000, so that the aggregate loss on the markets from these sources must be enormous.

A marked correlation was found, in an investigation of the Georgia shipments, to exist between heavy rainfall, such as marked the year 1928, and the incidence of brown rot, which caused over

20 times as much decay of peaches in that year as in the dry season of 1925. *Rhizopus* on the other hand, is practically unaffected by weather conditions, its occurrence in transit being almost entirely determined by picking, packing, and shipping factors. In 1925 nearly one-third more of the cars inspected showed this rot than in 1928.

The relation of temperature to the development of rot during the usual marketing period is discussed. One day at 75° F. is practically equivalent to 3 at 50°, 7 at 41°, or 25 at 32°. The brown rot fungus does not thrive at a temperature of 90° or above. *R. nigricans* gains as firm a hold in one day at 85° as in 3 at 59° or in 10 at 50°, the last-named temperature, in fact, being almost sufficient to prevent the development of this organism.

In refrigerated cars loaded with peaches in crates the inspection reports show 7·8 times as much brown rot and 15·6 times as much *Rhizopus* rot in the fourth or top as in the first or bottom layer, while in cars loaded with baskets there was 4·8 times as much brown rot and 5·4 times as much *Rhizopus* rot in the third or top as in the first or bottom layer. It was shown by test shipments with peaches in crates that during a journey of $3\frac{1}{2}$ to $4\frac{1}{2}$ days, the temperature at the top of the load averaged 12·5° higher than that at the bottom. The fruit at the top took about eight times as long to reach a temperature of 59° and five times as long to reach 50° as that at the bottom.

Four methods of reducing the excessive spoilage at the tops of cars are discussed. *Rhizopus* rot can be practically eliminated as a factor in spoilage and the development of brown rot considerably retarded by precooling the fruit to a temperature of 50°. Various types of blowers have been devised to reverse and intensify the air movement in the car by forcing the cold air up through the bunkers and out over the top of the load. Four to six hours of operation are usually necessary for satisfactory results by this process. The addition of salt to the ice (2 to 4 per cent. of the weight of the latter) in the bunkers greatly assists in checking the rots and retarding the softening of the fruit. A full account of the experiments with solid carbon dioxide has already been noticed [loc. cit.].

ESAU (P.) & CRUESS (W. V.). **Yeasts causing 'souring' of dried Prunes and Dates.**—*Fruit Products Journ.*, xii, 5, pp. 144–147, 1933.

Considerable losses are stated to be caused in California by the 'souring' of dried prunes in storage and in the final package, as well as by that of fresh dates after packing [*R.A.M.*, xi, p. 384; cf. also x, p. 679].

Six strains of, apparently, Torulaceae, and one species of *Mycoderma* were isolated from prunes that had soured in commercial storage, while fresh dates in a similar condition yielded a strain of *Saccharomyces ellipsoideus* and a species of *Torula* [cf. ibid., xi, p. 572]. The alcohol-forming power of all the yeasts except *S. ellipsoideus* was found to be relatively low. With one exception the prune yeasts failed to grow in prune pulp of 24 per cent. moisture content or less, and all produced a 'soured prune' odour

in liquid media in contrast to the smell of wine characterizing the date *Torula*.

The prevention of prune souring evidently lies in drying the fruit below the moisture content requisite for yeast growth (22 per cent. in one case). The occurrence of a similar condition in dates may be obviated by pasteurization of the fruit in sealed containers at a temperature and for a time sufficient to bring the fruit to 60° C. or above. The flavour of dates appears, from previous laboratory experiments, to be seriously impaired by temperatures at or near the boiling point of water but not by those below 65°.

The biochemical characters of the yeasts are tabulated. Most of those isolated from prunes utilized tartaric acid and grew better on succinic than on malic acid. The average dimensions of the *Torula* strains from prunes ranged from 3·5 to 6·8 by 3 to 5·1 $\mu$, those of the *Mycoderma* being 7 by 4·5 $\mu$. The date *Torula* measured 5·1 by 5·1 $\mu$ and utilized sucrose, levulose, maltose, lactose, glucose (gas and acid formation), galactose (acid), mannose, mannite, salicin, and xylose.

Du Plessis (S. J.). **Spraying experiments for the control of the anthracnose disease of Almonds.**—*South Africa Dept. of Agric. Bull.* 116, 9 pp., 1 graph, 1932.

Details are given of experiments conducted in 1931 at Stellenbosch, Cape Province, to determine the relative efficacy of commercial and home-made Bordeaux mixture, lime-sulphur, copper-lime dust, vomasol S, and vomasol C [*R.A.M.*, xi, p. 650] in the control of anthracnose of almonds (*Gloeosporium amygdalinum*) [ibid., xi, p. 249]. The trees selected for treatment were 8-year old ones of the Papershell, Jordan, Nil Melior, and I.X.L. varieties growing in red loam with a clay subsoil. The dormant treatments (Bordeaux mixture 4–4–50, lime-sulphur 1 in 15, vomasol S 1 in 300, vomasol C 1 in 400, and copper-lime dust $\frac{3}{8}$ lb. per tree) were given on 8th July, and the three spring applications (Bordeaux mixture 4–4–100, lime-sulphur 1 in 100, vomasol S and C 1 in 400 and 1 in 800, respectively, and copper-lime dust $\frac{1}{2}$ lb. per tree) on 12th and 28th August and 11th September. The sprays were applied by an ordinary power-spray pump at a pressure of 400 lb. per sq. in., and the dust with a vineyard sulphur duster.

Bordeaux mixture proved to be the most efficient of the fungicides tested, the full schedule increasing the yield by 474 to 882 per cent. over that of the controls, while one winter and two summer applications gave an increase of 103 to 356 per cent. and one winter and one summer treatment of 41 to 80 per cent. Copper-lime dust, lime-sulphur, and vomasol C reduced infection and proved about equally efficacious with one winter and two summer applications of Bordeaux mixture. The total cost of the Bordeaux treatments (including labour, materials, and depreciation) was £5 6*s.* 3*d.* per 100 trees, the corresponding amount for the home-made preparation (the materials for which proved much cheaper), being £2 2*s.* 3*d.* The following increased yields were obtained per 100 trees of each variety: Papershell, 392 lb. at 6*d.* per lb. = £9 16*s.* 0*d.*; Jordan, 140 lb. at 2*d.* = £1 3*s.* 4*d.*; Nil Melior, 281 lb. at 6*d.* = £7 0*s.* 6*d.*; and I.X.L., 280 lb. at 6*d.* = £7 0*s.* 0*d.*

DARROW (G. M.) & DETWILER (S. B.). **Currants and Gooseberries: their culture and relation to White Pine blister rust.**—*U. S. Dept. of Agric. Farmers' Bull.* 1398, 41 pp., 26 figs., 2 maps, 1933.

This is a revision of the writers' earlier bulletin (1024 of the Farmers' series) [*R.A.M.*, iv, p. 100] which is superseded. A. L. Quaintance contributes the section on insect pests and Louise Stanley that on ways of using the fruits, while Maude A. Thompson has compiled a summary of the more important State laws relating to the control of white pine blister rust [*Cronartium ribicola*: see below, p. 400].

LAUBERT (R.). **Ungewöhnlicher Rostbefall an zahlreichen Ribes-Arten.** [An unusual rust attack on numerous species of *Ribes*.]—*Mitt. Deutsch. Dendrol. Gesellsch., 1932,* xliv (*Jahrb.*), pp. 411–413, 1932.

*Aecidium grossulariae*, the aecidial stage of *Puccinia ribesii-caricis* [*R.A.M.*, xi, p. 24], developed with unusual intensity on gooseberry leaves, petioles, shoots, and fruit in the vicinity of Berlin during May and June, 1932. Among other species of *Ribes* attacked by the rust, apparently for the first time, were *R. americanum*, *R. gordonianum*, *R. nevadense*, *R. nigrum* × *petraeum*, *R. rubrum* × *multiflorum*, *R. uva crispa,* and *R. vilmorinii*. Infected bushes were observed at a very considerable distance from any of the alternate hosts (*Carex* spp.) the sporidia from which must, therefore, be blown a long way by the wind.

DEL CAÑIZO (J.) & SARDIÑA (J. R.). **La enfermedad de la Platanera en el Valle de la Orotava.** [The Banana disease in the Orotava Valley.]—*Bol. Pat. Veg. y Ent. Agríc.*, vi (*1931*), 23–26, pp. 1–34, 14 figs., 1932.

The Panama disease of bananas is stated to have been first reported in the Orotava Valley, Teneriffe, in September, 1925, the causal organism being recently identified by Dr. H. W. Wollenweber as *Fusarium oxysporum* f. 3 [syn. *F. cubense*: *R.A.M.*, xi, p. 281]. In 1924, however, a fungus isolated from diseased material of *Musa cavendishii* sent to the Imperial Mycological Institute by the United Fruit Company from the Canaries had been identified, with the aid of Prof. S. F. Ashby and Dr. E. W. Brandes, as *F. cubense*. During 1927 and 1928, years of scanty rainfall, the disease declined in prevalence, to reappear with alarming intensity in 1929 and 1930.

The symptoms and etiology of the disease, and the morphological and cultural characters of the fungus are described at length, while observations are made on the conditions of banana growing in the island. Discussing the possibilities of control, the writers state that good results have been obtained by the application to the soil of lime at the rate of 2,000 to 2,500 kg. per hect. Suggestions are made for the correct proportions of fertilizers, and directions given for the eradication of infected plants, the sterilization of the soil by quicklime (1 part to 3 of soil) or formalin (60 gm. per sq. m.), and the establishment of new plantations.

WARDLAW (C. W.). **Banana diseases. V. Fusarium tip-rot of immature Cavendish fruits.**—*Trop. Agriculture*, x, 1, p. 6, 1 pl. [facing p. 5], 1933.

The author states that in addition to the diseases of bananas dealt with in the previous communications of this series [*R.A.M.*, xi, p. 464], a tip rot of immature Cavendish bananas has occasionally been found in different parts of Trinidad, most usually on very young fruits not yet containing starchy pulp. The rot [which is briefly described] is of no great economic importance, because as a rule only two or three fingers in a bunch are affected, but occasionally a whole hand may be rendered unsightly. Isolations from the decaying fruits most commonly yielded *Fusarium moniliforme* var. *subglutinans* [ibid., v, p. 617] and *F. lateritium* [ibid., xi, p. 306], usually accompanied by bacteria. Inoculation experiments during the wet season on immature Cavendish fruits gave negative results with both fungi, and this fact, taken in conjunction with the occasional occurrence of the disease in nature, suggests that penetration of the fruits by the associated fungal organisms can be effected only under the influence of some predisposing internal or external factor.

CONDIT (I. J.) & HORNE (W. T.). **A mosaic of the Fig in California.**—Abs. in *Phytopath.*, xxiii, 1, p. 7, 1933.

Figs in California are stated to suffer very generally from a mosaic-like disturbance of no apparent commercial importance. The leaves exhibit mottled areas and may be distorted, while shedding of both foliage and fruit occurs in severe cases. No insect vector of the disease has been detected. Cuttings from affected trees propagated in the greenhouse continue to show mosaic. Seedlings from diseased plants have remained healthy for about a year in the greenhouse, whereas buds from healthy seedlings set in diseased trees have grown into mosaic shoots. After several years in the orchard much mosaic is shown by seedlings. The disease under investigation appears to be a true mosaic.

GASSNER (G.) & GOEZE (G.). **Über die Wirkung einiger Pflanzenschutzmittel auf das Assimilationsverhalten von Blättern.** [On the effect of some plant protectives on the assimilatory capacity of leaves.]—*Ber. Deutsch. Bot. Gesellsch.*, l, 10, pp. 517–528, 1933.

The methods used by the writers in their studies on the effects of certain plant protectives on the assimilatory capacity of leaves were essentially similar to those employed in earlier investigations on the action of potash on wheat foliage [*R.A.M.*, xi, p. 704]. Certain adjustments, however, were made in the carbonic acid content of the assimilation chamber, the aerial velocity being changed from 8 to 5 or 6 m. per 3 l. and the number of leaves exposed to the current reduced from 8 to 6.

Dusting the leaves of v. Rümker's early Sommerdickkopf with ground sulphur or elosal [ibid., vi, p. 394; cf. also xi, p. 767] at

21·5° C., 24 to 72 hours before the determination of assimilatory capacity, did not appreciably influence the latter. On the other hand, the application of calcium cyanamide dust at the rate of 10 or 20 per cent. with 90 or 80 per cent. kaolin [ibid., x, p. 88] up to 48 hours before estimation caused a marked reduction of assimilatory activity (as much as 40 per cent. at the maximum rate and duration). No such effects were observed, however, when the treatment was given immediately before determination. Gassner and Appel have shown [ibid., vii, p. 82] that a decline in the assimilatory capacity of cereal leaves is accompanied by a corresponding reduction in the incidence of rusts [*Puccinia* spp.], and hence it may be supposed that the efficacy of calcium cyanamide against these diseases is correlated with its depressing action on this function. In spraying experiments with 1 per cent. nosprasit [ibid., xii, p. 31 *et passim*], Bordeaux mixture, copper sulphate, and copper chloride, the reduction of assimilation was greatly enhanced by the removal of the wax layer from the leaves; this effect, combined with marked injury to the foliage, was particularly noticeable in the case of copper chloride. No effect on the assimilatory capacity of wheat seedlings raised from seed-grain immersed for an hour in 0·25 per cent. uspulun or germisan could be detected in tests on the first leaf. On the other hand, seedlings grown in sand treated with mercuric chloride at concentrations of 1 in 1,200,000, 1 in 400,000, and 1 in 120,000 showed a pronounced decline of assimilatory energy proportional to the amounts of the fungicide employed. In garden soil a corresponding effect was observed only at the maximum strength of 1 in 120,000. None of the affected seedlings showed any external sign of injury.

ROLDAN (E. F.). **Four new diseases of Philippine economic plants caused by species of the family Pythiaceae.**—*Philipp. Agric.*, xxi, 8, pp. 541–546, 4 figs., 1933.

Sweet Cayenne pineapple plants in Laguna, Philippine Islands, are liable to a wilt disease caused by a species of *Phytophthora* [*R.A.M.*, xii, p. 303] which may affect up to 20 per cent. of the stand. Diseased plants turn yellow and may either collapse suddenly or show persistent symptoms of wilting; recovery has not been known to occur. The site of infection at the stem base is strongly discoloured with irregularly zonate water-soaked areas.

A species of *Pythium* with smooth, globose or subglobose oospores is responsible for a virulent disease of abacá (*Musa textilis*) seedlings, causing damping-off of the roots, sometimes accompanied by leaf blight in the form of water-soaked blotches.

Avocado seedlings are also subject to infection by a species of *Pythium* with similar spores to the foregoing. The leaves droop, roll up gradually, and lose their green colour; in advanced stages the stem base may be shrunken and dark brown, and the rootlets decayed, soft, and flaccid.

Benguet and Chinese pine seedlings (*Pinus insularis* and *P. massoniana*, respectively) showed a water-soaked, shrunken, soft rot of the stem bases resulting in damping-off. The causal organism was found to be a species of *Pythium*, probably *P. de Baryanum*.

MOORE (ELIZABETH J.). **The use of phenosafranin for staining fungi on culture media or in host tissue.**—*Science*, N.S., lxxvii, 1984, pp. 23–24, 1933.

Phenosafranin has been found very useful in the study of bacterial and fungal colonies growing on an agar medium and also as a differential stain for hyphae in plant tissues. A solution is made up as follows: 20 gm. each of carbolic acid crystals, lactic acid syrup, and distilled water, 40 gm. glycerine, and 0·5 gm. or less phenosafranin. The stain is intensified by mordanting fixed sections for two hours with a 2 per cent. iron alum solution, while destaining may be effected by washing the material in a solution of 0·5 per cent. alum and 0·5 per cent. hydrochloride or in alcohol. After destaining a 1 per cent. ammonium hydroxide solution may be applied for setting or intensification. Destaining is superfluous for cultures on an agar medium, which absorbs the stain less readily than the cells.

Phenosafranin is superior to cotton blue except for hyphae in woody tissues, the lignified walls of which retain the stain as well as the hyphae.

THOM (C.) & RAPER (K. B.). **The arsenic fungi of Gosio.**—*Science*, N.S., lxxvi, 1980, pp. 548–550, 1932.

To determine the capacity of some moulds to produce toxic arsenical compounds from media containing arsenic [*R.A.M.*, viii, p. 573], 0·1 and 0·15 per cent. of arsenious oxide were added to Czapek's solution agar on which the mould was grown. All of the 15 species of *Penicillium* tested gave negative results, with the possible exception of a feeble reaction from *P. duclauxi*, while two out of 22 species of *Aspergillus*, viz., *A. fischeri* and *A. sydowi* gave an active response, and traces of arsenical gas were produced by *A. fumigatus*, a species allied to *A. glaucus*, and two of the *A. ochraceus* group. The writers' strains of the other genera reported active by Gosio (*Riv. d'Igiène e Sanita Pubblica*, iii, pp. 201, 261, 1892) and Huss (*Zeitschr. für Hyg. und Infektionskrankh.*, lxxvi, p. 361, 1914) proved negative. In subsequent tests ten strains of *Scopulariopsis* of the *P. brevicaule* type [ibid., xi, p. 6] and 14 strains of *A. sydowi* were all active producers of arsenical gas. Both these groups are common in soil and many other substances.

A number of common fungi grew well on the arsenical substrata without producing gas.

Studies were also conducted on Durham coarse sandy loam samples from areas in South Carolina previously reported by W. R. Albert and W. R. Paden (*Science*, N.S., lxxiii, p. 622, 1931) to contain enough arsenic to prevent the normal growth of certain crops. The most abundant moulds were two species of *Fusarium* and a few sterile forms producing brown to black mycelial masses. Gas containing arsenic was actively produced in arsenic agar cultures by the two species of *Fusarium*, one sterile brown fungus, and one strain of *Paecilomyces*.

The fungi under discussion do not appear to be exacting as to the form of arsenic presented, various commercial 'arsenicals' and products to which arsenic compounds were applied as preservatives

having been successfully utilized. This fact is of interest in relation to the use of copper and zinc arsenites in timber preservation [ibid., vii, p. 484; see also xi, p. 84].

The arsenic fungi are evidently more numerous than was formerly supposed and include some common soil saprophytes. Arsenical substances conveyed to the soil come into contact with decomposing agents tending to break them into volatile or rapidly soluble forms. Arsenical accumulations in the soil, however, need only be anticipated under the influence of massive amounts or in special conditions adverse to the development of a varied microflora. In the light of these data the use of arsenical timber preservatives should be avoided in enclosed areas.

MEIER (F. C.), STEVENSON (J. A.), & CHARLES (VERA K.). **Spores in the upper air.**—Abs. in *Phytopath.*, xxiii, 1, p. 23, 1933.

Spore collections made on five aeroplane flights over the eastern United States in 1932 at altitudes ranging from 500 to 18,000 ft. indicate that certain agents of plant disease may travel long distances in a viable condition before falling to start new local infections. Above 8,000 ft. the numbers usually declined considerably, but viable *Pestalozzia* spores were collected on 22nd March 18,000 ft. above Washington in a strong west wind. Species of a number of genera [which are listed] were identified.

HATCH (A. B.) & DOAK (K. D.). **Mycorrhizal and other features of the root systems of Pinus.**—*Journ. Arnold Arboretum*, xiv, 1, pp. 85–99, 4 pl., 1 fig., 1933.

An account is given of the writers' investigations on the distinctive anatomical and morphological features of the mycorrhizal and non-mycorrhizal root systems of *Pinus strobus* and *P. sylvestris* [cf. *R.A.M.*, xii, p. 183], part of the material having been studied by the senior author in Sweden, and the remainder by both at the Arnold Arboretum, Harvard University, and the Allegheny Forest Experiment Station, Philadelphia.

In ten experimental three-month-old seedlings of *P. sylvestris* examined at Stockholm, there was an average of 19 long or permanent and 474 short ephemeral roots per seedling, all of the latter, as a rule, being mycorrhizal, while the long ones are seldom associated with this type of fungus. In seedlings of *P. strobus* and *P. sylvestris* in pot cultures one of the writers observed that mycorrhizal development may occur at the tips of the long roots in the autumn, after their elongation has almost ceased. Probably the rapid elongation of the long roots is the main reason for their usual escape from mycorrhizal infection.

The short roots may be divided into three kinds, namely, uninfected, infected without mycorrhizal structure (pseudomycorrhiza), and infected with mycorrhizal structure (mycorrhiza). The first type is stated to be extremely rare, probably occurring only in pure cultures and in open, mineral solution sand cultures free from organic substances. Melin's description of the pseudomycorrhizal type [ibid., i, p. 124; iii, p. 470] applies equally well to the American material investigated. In external appearance a pseudomycorrhiza differs from an uninfected short root chiefly in its

shorter length and darker colour. The cells of the cortical region of a mycorrhizal short root of *P. strobus* grown in pure culture with *Lactarius deliciosus* [ibid., iii, p. 471] measure 43 and 40 $\mu$ in radial and longitudinal diameter, respectively, compared with 29 and 61 $\mu$ in uninfected short roots. There is thus a considerable increase in radial size (hypertrophy) as a result of infection. The diameter of the uninfected short root is 300 $\mu$ and that of the mycorrhiza (average in the case under observation) 485 $\mu$, an increase of about 62 per cent. Judging by the very slow growth of uninfected short roots, the writers find little support for the numerous references in the literature to the cessation of root growth following invasion by mycorrhizal fungi. On the contrary, the profuse dichotomy occurring after infection is a manifestation of continued growth that is probably restricted to the mycorrhizal roots. In one mycorrhizal short root of a test seedling of *P. strobus* there were some 50 individual growing tips, while 84 were counted in another case. There was no evidence that the total length to any one of these tips was less than would have been reached by an uninfected short root.

HATCH (A. B.). **True mycorrhizal fungus in contrast to Mycelium radicis atrovirens.**—Abs. in *Phytopath.*, xxiii, 1, p. 14, 1933.

A fungus with black mycelium isolated from black mycorrhiza of *Pinus sylvestris* in Sweden formed typical ectotrophic mycorrhiza in pure culture with *P. strobus* aud *P. resinosa*; it is provisionally named *Mycelium radicis nigrostrigosum.* On the other hand, mycelium of the *M. r. atrovirens* type [*R.A.M.*, vi, p. 681] isolated from the same kind of mycorrhiza on *P. sylvestris*, overgrew and killed similar pure culture seedlings. The latter fungus in aerated culture neither attacked the aerial portion of the seedlings nor formed mycorrhiza. Its optimum development apparently occurs on the surface of short roots transformed into mycorrhiza by other fungi [see preceding abstract].

NORD (F. F.) & WEIDENHAGEN (R.). **Ergebnisse der Enzymforschung. II Band.** [Results of enzyme research. Volume II.]—xii + 358 pp., 17 figs., 13 diags., 28 graphs, Leipzig, Akademische Gesellschaft M.B.H., 1933.

The following are the titles of the second series of papers on enzymatic research comprising the present volume. (1) The kinetics of enzyme reactions, by E. A. Moelwyn Hughes (English). (2) Cryolysis and its relation to the mechanism of enzymatic action, by F. F. Nord (German). (3) The stereochemical specificity of the esterases and the synthesizing action of the ester-splitting ferments, by P. Rona and R. Ammon (German). (4) The specificity of emulsin, by B. Helferich (German). (5) The experimental bases of enzymatic cane sugar cleavage, by R. Weidenhagen (German). (6) Isolation and properties of crystalline trypsin, by J. H. Northrop and M. Kunitz (English). (7) On chemical processes and on energy relations in the physiological decomposition and conversion of the carbohydrates and their cleavage products, by C. Neuberg and E. Simon (German). (8) Co-zymase, by K. Myr-

bäck (German). (9) On the energy metabolism of the yeast cell, by F. Windisch (German). (10) Glycolysis, by E. Lundsgaard (German). (11) The mechanism of dehydration, by A. Bertho (German). (12) Cytochrome and intracellular respiratory enzymes, by D. Keilin (English). (13) Peroxidase. A comparison with other iron-porphyrin catalysts in cells, by D. B. Hand (English). (14) Blood coagulation, by H. J. Fuchs (German). (15) Ferment models (organic catalysators with fermentative action), by W. Langenbeck (German). (16) The enzymatic function of mitochondria, by E. S. Horning (English).

LÜDTKE (M.) & ACHMED (H.). **Über einen pflanzlichen Welkstoff.** [On a substance causing wilting of plants.]—*Biochem. Zeitschr.*, cclvii, 4–6, pp. 256–266, 1933.

In the writers' culture experiments *Fusarium vasinfectum* from cotton plants, and *F. lycopersici* from tomatoes produced amine-like substances. In order to ascertain whether these were responsible for the wilting symptoms associated with the fungi in question, the effects of several bases and amino-acids on tomato and summer wheat seedlings were tested. The volatile amines were found to exert a particularly strong toxic action [*R.A.M.*, xii, p. 314].

REID (R. D.). **A study of the bactericidal, bacteriolytic or inhibitory substance produced by some moulds and some factors which influence its production.**—*Journ. of Bact.*, xxv, 1, p. 31, 1933.

This is an abstract of a paper read before the thirty-fourth Annual Meeting of the Society of American Bacteriologists, 28th to 30th December, 1932. A group of thirty moulds was studied for the presence of an inhibitory substance such as occurs, according to Fleming, in the broth filtrate of cultures of *Penicillium rubrum* [*R.A.M.*, x, p. 427]. None of the *Aspergillus* or *Mucor* spp. examined showed the capacity to produce the substance in question, which was formed, however, to a varying extent by *P. rubens*, *P. notatum*, and *P. chrysogenum*, as well as by *P. rubrum*, and proved toxic to *Staphylococcus aureus* and some other bacteria. The growth of *Corynebacterium diphtheriae*, for instance, was inhibited *in vitro*, but no protective action was afforded by the mould substance, nor was any local irritation produced at the site of injection in guinea-pigs. The inhibitory factor is non-dialysable through a collodion membrane and non-toxic to animals either by superficial administration or intraperitoneal injection. Heating at 60° to 90° C. is resisted by the inhibitory substance for short periods, but its active properties begin to decline after three weeks' storage at any temperature from 0° to 37·5° C. The moulds were cultivated on double strength veal infusion broth, the $P_H$ of which was found to increase with the development of the inhibitory substance, the maximum potency of the latter being reached at $P_H$ 8·0.

RICE (MABEL A.). **Reproduction in the Rusts.**—*Bull. Torrey Bot. Club*, lx, 1, pp. 23–54, 3 pl., 1933.

The author describes her cytological studies at Columbia University, New York City, on the aecidial stage of *Puccinia sorghi* [*P.*

*maydis*] from *Oxalis stricta* [*R.A.M.*, x, p. 784], *Aecidium punctatum* [ibid., ix, p. 602] from *Hepatica acutiloba*, *Puccinia violae* [ibid., v, p. 669] from *Viola cucullata*, and *Uromyces caladii* from *Arisaema triphyllum* [ibid., xi, p. 391], and discusses their significance in relation to the problems of sexual reproduction in the rusts. A review is given of some outstanding contributions to the literature on this subject.

SCHULTZ (E. S.) & RALEIGH (W. P.). **A new necrotic virus disease of Potatoes.**—Abs. in *Phytopath.*, xxiii, 1, p. 32, 1933.

A few British Queen potato plants at Eureka, California, showed a fine necrotic streaking of the leaf veins and petioles and slight streaking of the stems in 1929. The new disturbance differs from top necrosis or seedling streak in first attacking the older leaves and also in producing smaller necrotic lesions and no tuber decay. Turkish tobacco inoculated with the new virus by rubbing the leaves developed, within ten days, local pale green, afterwards white and finally brown, circular spots, but the infection did not always become systemic. Globe tomatoes and *Datura stramonium* contracted both local and systemic infection. The symptoms appeared sooner at 60° to 65° F. than at 70° to 75°. Although the manifestations of this British Queen streak on tobacco and tomato resemble those described for spotted wilt of the latter in Australia [*R.A.M.*, xii, p. 142], there is reason to suppose that the diseases are not identical.

SCHULTZ (E. S.) & RALEIGH (W. P.). **Resistance of Potato to latent mosaic.**—Abs. in *Phytopath.*, xxiii, 1, p. 32, 1933.

Inoculations with latent mosaic which is generally present in a masked form in Green Mountain and other potato varieties, failed to cause infection on certain potato seedlings, while others similarly treated became infected in every test. Under field conditions similar reactions to natural infection have been observed. Latent mosaic can cause severe necrosis in certain potato varieties and seedlings, while others are very resistant to it. The resistant seedling strains can be used to separate streak or mild, leaf rolling, or other types of mosaic from the latent form.

COCKERHAM (G.). **Variations in the total nitrogen content of normal and leaf roll Potatoes.**—*Proc. Leeds Phil. and Lit. Soc. (Scient. Sect.)*, ii, 8, pp. 375–382, 3 graphs, 1933.

After pointing out that it is evident from the literature of the subject that the presence of the potato leaf roll virus is associated with pronounced disturbances in the metabolism of nitrogenous substances in the host, the author describes an investigation into the total nitrogen content of normal and leaf roll potatoes carried out at the Scottish Plant-Breeding Station, Corstorphine, with material obtained from the same source and at the same time as that used in Barton-Wright's and M'Bain's study of the carbohydrate metabolism of normal and leaf roll potatoes [*R.A.M.*, xii, p. 48].

The results obtained [which are expressed graphically and fully discussed] showed that in the laminae of normal and leaf roll

potato plants the nitrogen content fluctuates daily, generally tending to rise during the day and fall during the night. The detailed nitrogen-time relationship was not, however, consistent in the three lots of material used. In the case of President and one set of Arran Victory, the nitrogen in the leaf roll laminae showed a marked lag in time behind that of the normal laminae, nitrogen accumulating and (presumably) being elaborated in the diseased plants later in the day. The fluctuations in the nitrogen content of the normal and leaf roll laminae of a second set of Arran Victory did not show this lag, though as in President and the first lot of Arran Victory, the evening maximum was reached later in the leaf roll laminae than in the normal.

The nitrogen contents of the normal petioles underwent similar fluctuations and followed the same general trend with time as those of the corresponding laminae, but the leaf roll petioles were anomalous in that an accumulation of nitrogen took place at night. The uneven nature of the diurnal curves showing the fluctuations in nitrogen content of the diseased plants indicated that the nitrogen exchange between leaf and petiole was continually subject to peculiarities in translocation.

The total nitrogen contents of the leaf roll laminae, as expressed by the mean diurnal values, were significantly lower than those for the normal laminae, and the ratio between the means approximated to a constant value for the three series of plants.

Tubers from the plants used in the investigation were examined just after the dormancy period had been broken in storage. Samples of the eye tissue (including small sprouts), the cortex and vascular tissue, and the medulla were taken from six tubers each of normal and leaf roll President and normal and leaf roll Arran Victory. No significant difference was noted with respect to the relative disposition of nitrogen in the three tissue groups between the normal and diseased tubers, but the actual amounts of nitrogen present in corresponding tissues were appreciably higher in the leaf roll tubers. It is considered justifiable to assume that the differences in the amount of nitrogen in normal and leaf roll laminae are chiefly due to differences in protein.

A bibliography of ten titles is appended.

DIPPENAAR (B. J.). **Environment and seed treatment in relation to common Potato scab.**—Abs. in *Phytopath.*, xxiii, 1, p. 9, 1933.

At each of five temperature stages between 13° and 25° C., inclusive, potato scab [*Actinomyces scabies*] development under controlled laboratory conditions was greatest at a soil moisture of 40 per cent. of the water-holding capacity of the soil, decreasing successively at 55, 70, and 85 per cent. Both scab and tuber development were favoured by a temperature of about 17° C. The disease was as well controlled by five or ten minutes' immersion in acidulated mercuric chloride as by the standard mercuric chloride or cold formaldehyde treatments, the first-named further being the most effective against *Rhizoctonia* [*Corticium solani*: cf. *R.A.M.*, xii, p. 110 *et passim*].

SCHICK (R.). **Über das Verhalten von Solanum demissum, Solanum tuberosum und ihren Bastarden gegenüber verschiedenen Herkünften von Phytophthora infestans. (Vorläufige Mitteilung zur Frage der biologischen Spezialisierung von Phytophthora infestans.)** [On the reaction of *Solanum demissum*, *Solanum tuberosum*, and their hybrids towards various strains of *Phytophthora infestans*. (Preliminary note on the problem of biologic specialization in *Phytophthora infestans*.)]—*Der Züchter*, iv, 10, pp. 233–237, 5 figs., 1932.

A tabulated account is given of the writer's inoculation experiments at Müncheberg, Mark Brandenburg, with a supposedly new physiologic form of the potato late blight fungus (*Phytophthora infestans*) from Streckenthin that had attacked (according to an oral communication) all Müller's hitherto completely resistant 'W' strains [*R.A.M.*, x, p. 545; xi, p. 667], sparing only a few hybrids of *Solanum demissum* and *S. tuberosum* and their $F_2$ and $F_3$ progeny [ibid., xii, p. 190]. Comparative tests were conducted with a local Müncheberg form of *P. infestans*. The plants were inoculated at the shoot tips with zoospore suspensions.

*S. demissum* proved to be immune from, and *S. tuberosum* susceptible to, both forms of the fungus; the $F_1$ progeny are so far immune. Some 50 per cent. of the back crosses between the $F_1$ generation and *S. tuberosum* were susceptible in seedling inoculation tests with the Müncheberg form, while some individuals immune from this form were susceptible to that from Streckenthin. One $F_3$ family consisted purely of types susceptible either to both forms or at any rate to the Streckenthin one, while in another, three types occurred, namely, susceptible to both, or only to that from Müncheberg, and resistant to both. The behaviour of the $F_3$ progeny indicates the probable existence of types immune from the Streckenthin physiologic form. It is at any rate apparent that there are physiologic forms of *P. infestans* characterized by a differential pathogenicity towards various hosts.

In 1927 the writer received from Dr. R. N. Salaman material of *S. etuberosum* (probably identical with *S. edinense*), which had contracted late blight in 1907 (after 20 years of complete immunity) and remained susceptible since that date. In the writer's experiments this strain proved susceptible both to the Müncheberg and Streckenthin forms, the latter, however, being much more active in sporulation on it than the former, from which *S. edinense* is practically immune in the field.

The work of breeding blight-resistant potato varieties becomes immensely complicated through the existence of physiologic specialization in the causal organism.

BLODGETT (F. M.), MADER (E. O.), BURKE (O. D.), & MCCORMACK (R. B.). **Total amount of copper applied and ratio of lime to copper in Bordeaux as important factors in Potato spraying.** —Abs. in *Phytopath.*, xxiii, 1, p. 5, 1933.

The results of four years' spraying experiments [chiefly against *Phytophthora infestans*] in New York State on Rural New Yorker potatoes indicated that the total amount of copper applied is an

important factor in the increase of yields, the maximum being secured by the use of 40 to 50 or 70 to 90 lb. copper sulphate per acre per season, according to the locality, in the form of Bordeaux mixture [*R.A.M.*, viii, p. 391; xii, p. 240]. Slightly better results were consistently given by mixtures made with high magnesium lime than by those prepared with high calcium lime.

MADER (E. O.). **Effect of pressure and amounts of copper applied in spraying Potatoes.**—Abs. in *Phytopath.*, xxiii, 1, p. 22, 1933.

In a four years' series of potato spraying tests [? chiefly against *Phytophthora infestans* in New York State: see preceding abstract], when nozzles with a small orifice (1·18 mm. in diameter) were used, the amount of spray fluid applied and the yield per acre increased with each rise of pressure up to 600 lb. With larger nozzle orifices no increase in yield was secured beyond 400 lb.

RALEIGH (W. P.). **A homemade colloidal copper spray.**—Abs. in *Phytopath.*, xxiii, 1, p. 29, 1933.

An effective colloidal copper spray for the control of potato late blight [*Phytophthora infestans*] was prepared by dissolving 1 lb. copper sulphate in 2 qt. water and adding 1 pint black-strap molasses and $\frac{4}{10}$ lb. lye dissolved in 1 qt. water. The mixture was allowed to stand until it turned yellow (usually about a day at room temperature) and then applied at the rate of the equivalent of 4 lb. copper sulphate to 50 galls. water. An advantage of this preparation is the relatively thin cover produced on the foliage, thereby facilitating the reading of mosaic percentages [*R.A.M.*, xii, p. 240].

RALEIGH (W. P.). **Fungicidal efficiency of a solution of mercuric chloride and potassium iodide.**—Abs. in *Phytopath.*, xxiii, 1, pp. 28–29, 1933.

The addition of 0·25 per cent. potassium iodide to a mercuric chloride solution (1 in 1,200) was found greatly to enhance the efficacy of the latter against *Rhizoctonia* [*Corticium solani*] on potatoes [*R.A.M.*, xi, p. 671]. Used as a dip, this compound was almost equally effective with 1½ hours' immersion in a 1 in 1,000 mercuric chloride solution, and more so than three minutes' immersion in 1 in 500 mercuric chloride or a dip in the same solution with the addition of 1 per cent. hydrochloric acid.

REINMUTH (E.) & FINKENBRINK (W.). **Experimentelles zur Frage der Eisenfleckigkeit der Kartoffel.** [An experimental contribution to the problem of Potato spraing.]—*Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz*, xliii, 1, pp. 21–28, 5 figs., 1933.

Of late years there has been a striking increase in the incidence of spraing in German potato crops, especially of the Industrie, Preussen, Juli, Erdgold, Parnassia, Seydlitz, and Jubel varieties. The condition in question may be almost indistinguishable from 'kringerigheid' [or 'internal rust spot': *R.A.M.*, x, p. 746; xii,

p. 239], but differs from heart necrosis [ibid., xi, p. 534] in the absence of external tuber symptoms.

The etiology of spraing being very obscure, though it is usually held to be associated with certain soil conditions or with disturbances of the water balance or of respiration, the writers undertook a series of pot culture tests in 1931 and 1932 at the Rostock Agricultural Experiment Station to determine the effects on the disease of manuring and of diminished tuber respiration. The pots were filled with a mixture of sandy clay (4·5 kg.) and glass sand (1·5 kg.), with which was incorporated, each in a parallel series of eight pots, 3 gm. ammonium sulphate, 3·5 gm. sodium or Chile saltpetre, 3 gm. 40 per cent. potash salt, 3 gm. superphosphate or 5 gm. basic slag, 9 gm. burnt lime, and ½ kg. sheep dung. Eight pots received a complete fertilizer and eight control pots received none.

The pots were planted in the middle of May with Erdgold and Seydlitz tubers from an infected source. Water was given to all the pots until the plants reached a height of 10 to 15 cm., when four of each series were treated with melted paraffin which, on cooling, hardened into a solid coating all round the stem bases, completely excluding air.

Respiration was found to be greatly impeded by the paraffin layer, as indicated by the extensive lenticel formation in the affected tubers. No consistent influence, however, on the development of spraing could be detected as a result of this. The addition of sheep dung to the pots appeared to promote the occurrence of spraing, but apart from this fact the outcome of the fertilizer tests [the data of which are shown in tabular form] was too conflicting to admit of any definite conclusion.

In a further test 28 diseased and 28 healthy Erdgold tubers were planted on a clay-sand soil to which a mineral fertilizer was applied. The progeny of the healthy tubers yielded 339 tubers of which 9 (2·7 per cent.) were diseased, the corresponding number from the infected lot being 269, of which 17 (6·3 per cent.) developed spraing. It is evident, therefore, that under certain conditions spraing may be carried through the seed.

TULLIS (E. C.). **Leptosphaeria salvinii, the ascigerous stage of Sclerotium oryzae.**—Abs. in *Phytopath.*, xxiii, 1, p. 35, 1933.

*Leptosphaeria salvinii* was found on greenhouse rice plants at Fayetteville, Arkansas, and on 16 different varieties at the Rice Branch Experiment Station in 1931. Cultures from ascospores in the following winter and spring produced sclerotia typical of *Sclerotium oryzae* and conidia characteristic of *Helminthosporium sigmoideum* [*R.A.M.*, xi, p. 469; xii, p. 12]. Inoculation experiments on rice with these sclerotia resulted in the production of perithecia, conidia, and sclerotia, thereby establishing the genetic connexion between the three stages.

MURRAY (R. K. S.). **Importation of Rubber budwood and budded stumps.**—*Trop. Agriculturist*, lxxx, 1, pp. 26–31, 1933.

In this report, written on the request of the Board of Management of the Rubber Research Scheme, Ceylon, the author concludes

that although there is always the possibility of the introduction of new parasitic organisms with imported *Hevea* plant material, at the present time there is no cause of special apprehension from this source in Ceylon, since most of the diseases of *Hevea* rubber known in the East occur there. He considers the regulations now in force fully adequate to cope with the possibility, and submits that any unnecessary restriction on the entry into Ceylon of high yielding budding material is greatly to be deprecated.

NORMAN (A. G.). **The natural decomposition of plant materials.**—*Science Progress, 1933*, 107, pp. 470–485, 1933.

The natural decomposition of plant materials, whether in soil or alone, is a microbiological process in which the carbonaceous constituents of the tissue are utilized by organisms for their growth and development [*R.A.M.*, xi, p. 3]. This operation is more rapidly and effectively performed by a mixed soil flora of fungi and bacteria than by any single type of organism. In a normal mixed flora decomposition, there is undoubtedly a sequence of active forms; the fungi probably predominate in the early stages by reason of their rapid development in the presence of readily available organic matter, but later they are superseded in numbers and activity by bacteria and actinomycetes.

The various constituents of plant material vary in availability, so that the extent of decomposition depends on the constitution of the substance in question. The hemicelluloses and cellulose are readily available, the former being removed early in the disintegration process, whereas lignin is almost unavailable and appears to accumulate in proportion as rotting proceeds. The elaboration of microbial tissue demands the presence of a considerable quantity of available nitrogen, which is transformed into microbial protein. Phosphate, potash, and other inorganic ions are similarly immobilized during the process of decomposition, but to a much less extent than nitrogen. The nitrogen and inorganic ions thus withdrawn from the soil are temporarily unavailable to higher plants, and thus the amount of organic matter present, and its availability, may determine the nitrogenous balance of a soil and its immediate fertility in relation to crops.

UPPAL (B. N.) & DESAI (M. K.). **Cumin powdery mildew in Bombay.**—*Bombay Dept. of Agric. Bull.* 169 of 1932, 16 pp., 4 pl., 1933.

A fully tabulated account is given of the investigations carried out from 1928 to 1932 on powdery mildew of cumin (*Cuminum cyminum*) in the Bombay Presidency [*R.A.M.*, xi, p. 282], where the crop occupies over 2,000 acres in North Gujarat. The filiform leaves of the plants are covered with a powdery, white growth, which rapidly spreads under favourable conditions to the flowers and fruits, giving them a floury appearance. Temperature is the most important factor in the development of mildew, which flourishes between 80° and 95° F., and an epidemic which may cause losses of up to 60 per cent. is likely to ensue if the maximum December temperatures fall within this range, with normal conditions following in January and February. On the other hand, if

cool weather prevails in December the disease does not assume a serious form. Precipitation is not essential to the occurrence of mildew, though it may stimulate initial infection under warm conditions.

The morphology of the causal organism, the *Oidium* stage of a species of Erysiphaceae, is described and its taxonomic position discussed. On account of its lobed haustoria and conidial characters the fungus is referred to *Erysiphe polygoni*. The minimum, optimum, and maximum temperatures for conidial germination are 16° to 18°, 20° to 22°, and 30° C., respectively. Experimental proof was obtained at Poona of the perennation of the fungus as dormant mycelium on the seed.

The disease was completely controlled by one application of sulphur (25 lb. per acre) at the flowering period, the cost of the treatment being Rs. 2.5.0 [about 3*s.* 4*d.*] and the time required 2 to 2½ hours, per acre.

DAVIS (R. L.). **Report of the Plant Breeder.**—*Rept. Porto Rico Agric. Exper. Stat., 1932*, pp. 11–17, 1 map, 2 figs., 1933.

In 1932, 88,600 cuttings of Mayaguez seventh- and eighth-year mosaic-resistant seedlings were distributed in Porto Rico [cf. *R.A.M.*, xii, p. 113], the area occupied by Mayaguez canes increasing from 500 acres in December 1931 to 1,135 acres in the April following, when Mayaguez 28, 42, and 7 occupied, respectively, 890, 134, and 66 acres. Among the imported varieties, P.O.J. 2878 both in controlled experiments and general field trials was superior to all other varieties tested in the San German Valley [see next abstract].

KUNTZ (P. R.). **Resistencia relativa al matizado de Cañas producidas en el pais comparadas con las importadas.** [The relative resistance to mosaic of native grown and imported Canes.]—*Puerto Rico Estac. Exper. Insul. Circ.* 101, 23 pp., 1 fig., 3 diags., 2 maps, 1932.

Full details are given of the writer's comparative observations in 1931 on the relative productivity and resistance to mosaic of the locally produced and imported sugar-cane varieties in Porto Rico. The results of the inspections indicated that the local varieties, P.R. 803, P.R. 807, and F.C. 916 compare very favourably with the imported both as regards yield and resistance to mosaic [*R.A.M.*, xi, p. 804]. Among the foreign canes P.O.J. 2878 proved superior in both respects to B.H. 10 (12) and S.C. 12 (4).

COSTANTIN (J.). **Essai d'une théorie expliquant le rôle des mycorhizes de la Canne.** [A suggested theory in explanation of the role of Cane mycorrhiza.]—*Comptes rendus Acad. des Sciences*, cxcvi, 5, pp. 315–318, 1933.

The writer further develops his theories regarding the part played by mycorrhiza in the prevention of degeneration in the sugar-cane at high altitudes [*R.A.M.*, vii, p. 403].

COSTANTIN (J.). **Objections à la théorie mycorhizienne.** [Objections to the mycorrhizal theory.]—*Comptes rendus Acad. des Sciences*, cxcvi, 6, pp. 378–382, 1933.

The writer discusses and refutes various objections that have been raised to his theory of mycorrhizal influence on the health of sugar-cane and other crops [see preceding abstract]. [An abridged version of these papers appears in *Comptes rendus Acad. d'Agric. de France*, xix, 6, pp. 191–196, 1933.]

UNAMUNO (L. M.). **Notás micológicas. IV. Especies nuevas o poco conocidas de hongos microscópicos del Protectorado Español de Marruecos.** [Mycological notes. IV. New or little known species of microscopic fungi of the Spanish Protectorate of Morocco.]—*Bol. Soc. Española Hist. Nat.*, xxxii, 10, pp. 495–502, 1 fig., 1932.

An annotated list is given of 31 fungi found in the Spanish Protectorate of Morocco, of which two are new to science (furnished with Latin diagnoses), and 24 reported for the first time from the region under observation.

SYDOW (H.) & MITTER (J. H.). **Fungi indici—I.** [Indian fungi—I.]—*Ann. Mycol.*, xxxi, 1–2, pp. 84–97, 1933.

One new genus (*Mitteriella*) and nine new species are included in the authors' annotated list of Indian fungi. The following records are of special interest. *Phyllactinia corylea* [*R.A.M.*, xii, p. 181] was found on jasmine leaves; *Pleospora bataanensis* and *Microdiplodia agaves* [ibid., iii, p. 305] on the foliage of *Agave americana*; *Ascochyta cycadina* on the leaves of *Cycas revoluta*; *Cercospora sissoo* Syd. n. sp. on the foliage of *Dalbergia sissoo*, causing pale yellow to greenish-grey discolorations. *Mitteriella zizyphina* Syd. n. sp. covers more or less extensive areas of the leaf surface of *Zizyphus rotundifolia* with its black or greyish-black mycelium which does not penetrate into the leaf. It is considered to be the conidial stage of some member of the Englerulaceae.

TENG (S. C.). **Fungi of Nanking. II.**—*Contrib. Biol. Lab. Sci. Soc. China*, Bot. Ser., viii, 1, pp. 5–48, 1932.

An annotated list is given of some 150 fungi recently collected in the Nanking district of China [cf. *R.A.M.*, xi, p. 545], of which the following may be mentioned. Sorghum was attacked by *Sphacelotheca cruenta* and *Cercospora sorghi*. Rice was infected by *Phoma glumarum* [ibid., i, p. 163; ii, p. 157]. *Piricularia grisea* was observed on *Eleusine indica* [ibid., ii, p. 259; viii, p. 292]. *Scolecotrichum graminis* [ibid., x, p. 10] occurred on *Phyllostachys* sp. Cotton (*Gossypium hirsutum*) showed infection by *Colletotrichum* [*Glomerella*] *gossypii* and *Pestalozzia gossypii* [ibid., xi, p. 746]. *C. nigrum* was found on chilli (*Capsicum annuum*) [ibid., xi, p. 803]. Asparagus was attacked by *Phoma asparagi*. *Phomopsis vexans* was observed on eggplants. *Cercospora cannabis* occurred on *Cannabis sativa*, *C. nicotianae* on tobacco, and *C. personata* on groundnuts. Cowpeas were infected by *Uromyces vignae* [ibid., x, p. 810]. Vines were attacked by *C. viticola*, *Monochaetia uniseta*, *Gloeosporium ampelophagum*, *Macrophoma sicula*, *Phoma viticola*, and *P. cookei*. Apples are

commonly infected in this region by *Gymnosporangium yamadae* [ibid., x, p. 71], the alternate stage of which occurs on *Juniperus chinensis.* The latter also harbours the destructive pear rust, *G. koreaense* and its elimination is imperative. Mulberries (*Morus alba*) are liable to injury by *Aecidium mori* [ibid., x, pp. 343, 566]. *Gloeosporium foliicolum* was found on *Citrus nobilis* var. *microcarpa* leaves. Loquats (*Eriobotrya japonica*) suffer damage from *Monochaetia mali, Ascochyta eriobotryae* [ibid., viii, p. 486], and *Sphaeropsis malorum* [*Physalospora cydoniae*]. *Cercospora kaki* was found on *Diospyros kaki* [ibid., xi, p. 795]. *Zizyphus sativa* showed infection by *Phakopsora zizyphi-vulgaris. Pinus massoniana*, extensively employed in reafforestation projects, suffers heavy damage from the aecidial stage of *Cronartium quercuum*, the uredo-teleuto stages of which occur on oak (*Quercus serrata*) leaves and (apparently recorded for the first time) on those of chestnut (*Castanea mollissima*). *Lophodermium pinastri* was found on *Cunninghamia lanceolata. Crataegus cuneata* was attacked by *Podosphaera oxyacanthae. Sphaerotheca humuli* var. *fuliginea* [ibid., x, p. 500] was observed on *Helianthus annuus. Thea oleasa* was found infected by a fungus probably identical with *Meliola camelliae* [ibid., x, p. 492]. Silkworms (*Bombyx mori*) were parasitized by *Spicaria prasina* [ibid., x, p. 188].

TENG (S. C.). **Fungi of Chekiang.**—*Contrib. Biol. Lab. Sci. Soc. China*, Bot. Ser., viii, 1, pp. 49–71, 1932.

A list is given of 148 fungi (including two new species) recently collected by the writer in the Chekiang district of China, largely from fallen wood and from the soil.

KERN (F. D.), CIFERRI (R.), & THURSTON (H. W.). **The rust-flora of the Dominican Republic.**—*Ann. Mycol.*, xxxi, 1–2, pp. 1–40, 1933.

Critical and taxonomic notes are given on a further 55 species of rusts (six of which are described as new) in 17 genera from the Dominican Republic [*R.A.M.*, ix, p. 745], making the total for the country 180 (all included in the present list). A host index is appended.

CHARDON (C. E.). **New or interesting tropical American Dothideales. III.**—*Journ. Dept. Agric. Puerto Rico*, xvi, 2, pp. 167–192, 3 pl., 1932. [Received April, 1933.]

In this third paper of this series [*R.A.M.*, viii, p. 604] the author gives an annotated list of 44 species of Dothideales (mainly belonging to the genera *Catacauma* and *Phyllachora*) occurring in the American tropics. Over half of the species listed are described as new to science, and a Latin diagnosis is appended in each case. The notes include the hosts, localities, and in many cases critical annotations.

BLOCHWITZ (A.). **Die Gattung Aspergillus. Neue Spezies, synonyme und Nachträge.** [The genus *Aspergillus*. New species, synonyms, and addenda.]—*Ann. Mycol.*, xxxi, 1–2, pp. 73–83, 1933.

Notes are given on a number of species of *Aspergillus* described

since the author's systematic key to the genus [*R.A.M.*, viii, p. 675]. *A. awamori* Usami (*Mycol. Centralbl.*, iv, p. 194, 1914) differs from the type *A. luchuensis* [ibid., x, p. 636] in its euglobose vesicle, branched sterigmata, and absence of aerial growth, characters which are not considered to justify the establishment of a new species. Boedijn found a similar euglobose variant of *A. luchuensis* with branched sterigmata in Sumatra, and the writer also received a specimen of this type from Saito. The morphological and physiological characters of the fungus, which occurs in 'koji', are briefly indicated.

Critical and taxonomic notes are given on a number of other alleged new species which are regarded as synonyms, and some supplementary observations on various members of the genus are made.

PALM (B. T.). **On parasitic and epiphyllous Algae. I. A Chlorochytrium on Polygonum.**—*Rev. Algol.*, vi, 3–4, pp. 337–346, 8 figs., 1932.

In 1932 *Polygonum lapathifolium* leaves in Södermanland, Sweden, were found to be infected by an endophytic alga, closely resembling and possibly identical with *Chlorochytrium rubrum*. In fixed and stained material the young unicellular alga was first observed at rest on the epidermal surface of the leaf. At this stage it measures about 10 $\mu$ in diameter and is surrounded by a cellulose membrane. Subsequently entry is affected by the passage of the whole, presumably amoeboid body (whether a zygote or an aplanospore is uncertain) through the stomatal aperture, and the alga then broadens and elongates into a ball-shaped cell which completely fills the stomatal chamber. The outer wall of the cell shows an irregular thickening, chiefly near the leaf epidermis, while on the inner wall corresponding protuberances are formed that project for a varying distance into the protoplasm of the algal cell. The alga undergoes a typical resting stage in which the resting sporangium is filled with small oil globules; the sporangial membrane shows the irregular swellings characteristic of the earlier phases. *C. rubrum* appears to dissolve the walls of the adjacent host-cells so as to form a symplast around it and produces minute galls on the leaves of its host, so that it must be regarded as a true parasite.

PALM (B. T.). **Rhodochytrium en Amérique Centrale.** [*Rhodochytrium* in Central America.]—*Rev. Algol.*, vi, 3–4, pp. 351–353, 1932.

*Rhodochytrium spilanthidis*, a Protococcoid alga, is known to occur in North and South America and the Dutch East Indies, where its hosts include *Ageratum, Ambrosia, Solidago, Spilanthes*, and *Asclepias* spp., and *Hibiscus sabdariffa* [*R.A.M.*, xi, p. 301]. Recently a new host has been detected in the mountains of Guatemala, 5,000 to 7,000 ft. above sea-level, namely, *Spilanthes beccabunga*, the infected plants of which assume a reddish coloration, accompanied by an abnormal elongation of the peduncles and, in cases of severe infection, of the leaves.

BEALE (HELEN P.). **Serologic reaction as a means of determining the concentration of Tobacco mosaic virus.**—Abs. in *Phytopath.*, xxiii, 1, p. 4, 1933.

Green leaf extracts of Turkish tobacco affected by mosaic (Johnson's No. 1 virus) [*R.A.M.*, xii, p. 119] were tested for their capacity to form precipitates when mixed with serum of rabbits hyper-immunized against homologous extracts [cf. ibid., xii, p. 314]. The concentration of active virus in each extract was independently ascertained by the number of local lesions resulting from the inoculation of *Nicotiana glutinosa* [see next abstract], according to Holmes's method [ibid., xii, p. 118]. A correlation was found to exist between the virus concentration of the various extracts and their capacity for anti-serum precipitation, suggesting that the precipitin reaction may be of value for the rapid and accurate determination of the relative strength of virus extracts.

BIRKELAND (J. M.). **Experiments in acquired immunity in Tobacco mosaic and spot necrosis.**—Abs. in *Phytopath.*, xxiii, 1, p. 5, 1933.

*Nicotiana glutinosa* plants in the writer's tests failed to develop acquired immunity as a result of inoculation with the tobacco mosaic [see preceding abstract] or spot necrosis virus. One series of plants was tested four, and another eight weeks after the initial infection. New leaves were inoculated and the number of local lesions used as a criterion of susceptibility. No significant difference was found in the number of lesions produced on the previously inoculated plants and on the controls. Similar results were given by plants inoculated with mosaic and tested with spot necrosis, and vice versa. In some cases there was apparently more secondary necrosis round the primary lesions on the already infected plants than on the controls.

NOLLA (J. A. B.). **The damping-off of Tobacco and its control in Puerto Rico.**—*Journ. Dept. Agric. Puerto Rico*, xvi, 2, pp. 203–204, 1932. [Received April, 1933.]

The author briefly describes the symptoms of damping-off of tobacco seedlings in Porto Rico, caused by *Pythium de Baryanum* and *Phytophthora parasitica* var. *nicotianae* [*R.A.M.*, xi, p. 677], and discusses the various methods tested for its control, of which two applications of Bordeaux mixture (4–4–50 and 5–5–50) to the soil, one a week before sowing the seed and the second two weeks after germination, proved to be the only effective treatment so far found. It is pointed out, however, that when copper-containing fungicides are applied to the soil following a crop of tobacco seedlings, injury to the next crop results.

**Amtliche Pflanzenschutzbestimmungen.** [Official plant protection regulations.]—*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, iv, 5, pp. 159, 165–170, 1933.

GERMAN REPUBLIC. A Decree dated 9th November, 1932 (effective from 15th December) requires that all Indian azaleas (*Azalea indica*) [*Rhododendron indicum*] imported into Germany must be accompanied by a duly authenticated certificate vouching

for their freedom from infection by *Septoria azaleae* [*R.A.M.*, x, p. 734] and *Exobasidium azaleae* [*E. vaccinii*: ibid., viii, p. 649].

WESTPHALIA. By virtue of a Decree of 16th August, 1932 (effective until 1st October, 1942), any person suspecting the occurrence of canker (*Nectria coccinea* var. *sanguinella*) in Canadian poplars [*Populus canadensis*: ibid., x, p. 698] must report within a week to the local police. Should the existence of the fungus be confirmed by experts, immediate arrangements must be made for the removal of diseased material. For the time being the further planting of *P. canadensis* in the administrative districts of Ahaus, Beckum, Borken, Coesfeld, and Tecklenburg is prohibited.

SOUTHERN RHODESIA. Government Notice No. 462 of 5th August, 1932, prohibits the importation into Southern Rhodesia, from overseas and from other States within the continent of Africa not subscribing to the regulations of the plant exchange list, of certain trees; fresh citrus fruits and dried peel (except candied peel); elm (*Ulmus*) seeds and plants from Europe or any country in which *Graphium* [*Ceratostomella*] *ulmi* is known to occur; chestnut (*Castanea*) seeds and plants from North America or any other country in which *Endothia parasitica* is known to be present. Sugar-cane, vine, banana, cacao, tea and coffee plants, plants grown for rubber production, and citrus trees, graft wood and seeds, together with certain plant products may be imported by the Department or by special permit and under proper safeguards.

Certain neighbouring States have concluded a Convention with Southern Rhodesia for the purposes of facilitating trade in plants and plant products under adequate safeguards, and the special regulations governing imports from these countries, which are included in a Plant Exchange List, are detailed. The countries listed are the Union of South Africa, Northern Rhodesia, and the Belgian Congo.

**Décret No. 49000/1932 vii–3 du Ministre royal hongrois de l'Agriculture portant règlement sur le Service hongrois pour la protection des plantes.** [Decree No. 49000/1932 vii–3 of the Royal Hungarian Ministry of Agriculture for the regulation of the Hungarian Plant Protection Service.]—pp. 1–4, 1932.

This Decree issued by the Minister of Agriculture dated 18th August, 1932, effective as from 1st October, provides for the establishment of the 'Hungarian Plant Protection Service', consisting of a plant protection council composed of representatives of the relevant scientific interests, delegates of the Ministries of the Interior, Finance, and Commerce, members of institutions connected with the plant protection organization, as well as producers and manufacturers; the Plant Protection Research Institute, divided into three sections, viz., phytopathological, entomological, and phytobiochemical; the central organization for practical plant protection; and the provincial organization for the same purpose. The functions of the phytopathological section of the Research Institute will include the study of fungous diseases and their agents, the physiological disorders of cultivated plants, and the

development of control measures. These investigations will be supplemented by the work of the phytobiochemical section.

**United States Department of Agriculture. Bureau of Plant Quarantine. Service and regulatory announcements, July–September, 1932. Announcement relating to black-stem-rust quarantine (No. 38). Revised list of Barberries and Mahonias classified under black-stem-rust quarantine regulations.**—pp. 52–53, 1932.

As a result of recent experimental work by the Bureau of Plant Industry, the reaction to black stem rust [*Puccinia graminis*] of a number of species and varieties of barberry has been definitely ascertained, so that they can now (15th August, 1932) be placed in their appropriate categories as immune, resistant, or susceptible [*R.A.M.*, xi, p. 352]. For the first time *Berberis aemulans*, *B. buxifolia*, *B. diversifolia*, *B. gagnepainii*, *B. nervosa*, and some others are included in the list of species sufficiently resistant for shipment under permit into the protected States; while *B. dulcis nana*, *B. japonica* (*bealei*), and *B. levis* are added to the 96 others that are classed as susceptible and may not be moved into the protected States under any circumstances. The following are immune: *B. thunbergii* and its varieties *atropurpurea*, *maximowiczii*, *minor*, *pluriflora*, and *pluriflora erecta*. The reaction of a further 19 varieties is still under investigation.

**United States Department of Agriculture. Bureau of Plant Quarantine. Service and regulatory announcements, July–September, 1932. Announcements relating to White-Pine blister-rust quarantine (No. 63). Revision of White-Pine blister-rust quarantine regulations.**—pp. 53–61, 1932.

As from 1st January, 1933, Iowa, Maryland, Ohio, Virginia, and West Virginia are added to the list of States designated as infected by white-pine blister-rust (*Cronartium ribicola*) [see above, p. 381], while the District of Columbia, being surrounded by infected States, is also classed as infected though the disease has not yet been found within its limits. From these areas no 5-leaved pines or currant or gooseberry bushes (cultivated or wild) may be moved to any other State except under specified conditions. The inter-state movement of *Ribes nigrum*, *R. bracteosum*, and *R. petiolare* is prohibited except between 12 [listed] States. For 5-leaved pines a Federal permit is required for shipment from an infected State and a State inspection certificate from all others. The embargo prohibiting the movement of 5-leaved pines from points east of the Missouri Valley to the Western States is removed, and the inter-State transport of currant and gooseberry plants is further simplified by the elimination of the provision requiring immersion in lime-sulphur before dispatch; this will only be necessary in future in the case of plants shipped with leaves or active buds. Full details are given of the regulations.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW

OF

# APPLIED MYCOLOGY

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TAKAHASHI (W. N.) & RAWLINS (T. E.). **Rod-shaped particles in Tobacco mosaic virus demonstrated by stream double refraction.**—*Science*, N.S., lxxvii, 1984, pp. 26–27, 2 diags., 1933.

Further details are given of the technique of the methods used by the writers in the demonstration by means of stream double refraction [*R.A.M.*, xii, p. 234] that the particles in the tobacco mosaic virus are rod-shaped.

CLAYTON (E. E.). **Relation of the toxin produced by Bacterium tabacum to the pathogenicity and host range of this organism.**—Abs. in *Phytopath.*, xxiii, 1, p. 6, 1933.

The typical wildfire symptoms on tobacco leaves in the United States are stated to be due to the destruction of chlorophyll by a powerful exotoxin secreted by *Bacterium tabacum*. This substance is thermostable; not precipitated by mercuric chloride, neutral calcium acetate, or neutral lead acetate; not removable from solution by charcoal; able to pass through Berkefeld, collodium, and cellulose filters; resistant to acids but rapidly inactivated by dilute sodium or potassium hydroxide. Leaf-prick inoculations with (a) toxin, (b) toxin and bacteria, and (c) bacteria gave from (a) and (b) typical wildfire symptoms on many species of plants, but from (c) consistent positive results were obtained only on *Nicotiana* spp. The toxin inoculations indicated that tobacco leaf tissues are no more susceptible to injury from this agency than tomato or egg-plant and decidedly less so than bean [*Phaseolus vulgaris*] or cucumber. The (b) inoculations showed that the bacteria persist for some time in the tissues of all the above-mentioned plants. On re-isolation they were inoculated into field tobacco and produced heavy infection with subsequent spread, while the other test crops developed occasional lesions without further extension.

NOLLA (J. A. B.). **The damping-off of Tobacco and its control in Puerto Rico.**—*Journ. Dept. Agric. Puerto Rico*, xvi, 3, pp. 285–324, 11 pl., 1932. [Received April, 1933.]

This is a much expanded version of the author's note on the damping-off of tobacco seedlings (*Pythium de Baryanum* and

*Phytophthora parasitica* var. *nicotianae*) in Porto Rico [*R.A.M.*, xii, p. 398], especially in the part dealing with experiments on the control of the disease. In addition to the information already noticed, it may be mentioned that under local conditions soil sterilization by steaming or with formaldehyde does not appear to be practicable. Mercury compounds were found to be injurious to the seedlings and ineffective against the pathogens. While in preliminary trials two applications of corona copper carbonate dust at the rate each of 4 gm. per sq. ft. were fairly effective, they gave disappointing results in the field, presumably owing to heavy rains and to overcrowding of the seedlings. Copper stearate at the same rate of application seemed to control *Pythium de Baryanum* but not *Phytophthora parasitica* var. *nicotianae.*

CLAYTON (E. E.) & GAINES (J. G.). **Downy mildew of Tobacco.**—*U.S. Dept. of Agric. Circ.* 263, 7 pp., 3 figs., 1933.

A popular account is given of the history, symptoms, life-cycle, and means of control of tobacco downy mildew or blue mould (*Peronospora hyoscyami*) in the United States [*R.A.M.*, xii, p. 146]. According to competent observers this disease, as manifested in 1932, shows all the destructive features that have long rendered it the most serious problem of Australian tobacco growers [ibid., xii, p. 201]. It was an important factor in a 350,000-acre decrease in the 1932 crop of flue-cured tobacco in North and South Carolina and parts of Georgia. Attempts to control it by spraying in the first two of these States are reported to have given unsatisfactory results, while in Maryland and Georgia some success was obtained.

STOVER (W. G.) & VERMILLION (M. T.). **Some experiments with a yellow mosaic of Tomato.**—Abs. in *Phytopath.*, xxiii, 1, p. 34, 1933.

Tomato leaves [? in Ohio] were affected by a virus disease in which the chlorotic areas are irregular in shape and of a much paler colour than those of ordinary mosaic. Inoculation experiments gave successful results on tomato, tobacco, pepper [*Capsicum annuum*], and *Solanum nigrum*, while the susceptibility of *S. dulcamara* is doubtful. Pepper suffered more severely from the yellow than from ordinary mosaic, the leaves and blossom buds falling off and many plants being killed. The yellow mosaic virus was inactivated at about 83° C., and that of ordinary mosaic at 90° in the writers' tests. 'Streak' develops when healthy tomato plants are double-inoculated from tomatoes with yellow mosaic and from potato plants [cf. *R.A.M.*, xii, pp. 48, 250].

HEUBERGER (J. W.) & NORTON (J. B. S.). **Water loss in Tomato mosaic.**—Abs. in *Phytopath.*, xxiii, 1, p. 15, 1933.

Detached mosaic tomato leaves lost 62 per cent. of their weight by drying as compared with 39 per cent. for healthy ones. Tests showed that transpiration was much more rapid in diseased than in healthy foliage. Plants grown in a nutrient solution gave a higher transpiration rate per unit of dry weight and of leaf surface in cases of long infection by mosaic than in a normal state. A

sharp drop in transpiration coincided with the appearance of the first visible symptoms, followed by a gradual increase.

CHAMBERLAIN (E. E.). **Wilt diseases of Tomatoes due to Fusarium lycopersici and Verticillium albo-atrum.**—*New Zealand Journ. of Agric.*, xlvi, 1, pp. 38–45, 4 figs., 1933.

Considerable annual losses are sustained by New Zealand tomato growers through attacks by *Fusarium lycopersici* and *Verticillium albo-atrum* [*R.A.M.*, iv, p. 69]. The former disease, first recorded in New Zealand in 1906, is now prevalent throughout the country and is particularly troublesome in glasshouses; infections of up to 50 per cent. of the crop have been recorded both in the glasshouse and the field, though this figure is exceptional for outdoor crops. If the plants become infected before they come into bearing a total loss is sustained, otherwise damage may be slight. Fruit infection has not been observed, and there is no evidence to show that the organism is seed-borne. *Verticillium* wilt, first recorded in New Zealand in 1924, is less prevalent than *F. lycopersici*, but may cause serious damage either in the glasshouse or the field; in New Zealand the fungus has been reported only on tomatoes and potatoes. In 1932, 80 per cent. infection was reported in one garden at Gisborne, and *V. albo-atrum* sometimes causes fairly severe losses in the Nelson district. None of the tomato varieties grown in New Zealand has yet been tested for resistance to either wilt.

Brief recommendations are made for control through improved cultural practices and soil sterilization or disinfection.

HOLMES SMITH (E.). **Tomato mildew control.**—*Gard. Chron.*, xciii, 2404, pp. 46–47, 1 fig., 1933.

Small has shown that when the humidity of a glasshouse in England exceeds 70 per cent. and the temperature rises above 71·6° F., tomato mildew (*Cladosporium fulvum*) is almost sure to develop [*R.A.M.*, ix, p. 71]. Experiments have recently been conducted in Lancashire in the control of this disease by salicylanilide [ibid., xi, p. 679] with satisfactory results, four applications being found necessary for the complete destruction of the fungus. These were given on 30th May, 6th June, two to three weeks later, and again after a similar interval. The preparation was made up as follows: 1 oz. salicylanilide paste, 2½ oz. agral I, and 10 galls. water. The total consumption for the four applications at Blackpool amounted to roughly 1 gall. of spray per 20 to 25 plants or 8 oz. per plant, while at Hesketh Bank 1 gall. of spray was used per 18 plants or 9 oz. per plant. Both the salicylanilide paste (shirlan HB) and the sulphonated oil spreader (agral I) are now obtainable at most of the principal horticultural stores, the former costing 3*s*. 4*d*. to 4*s*. 4*d*. and the latter 1*s*. 8*d*. to 2*s*. 2*d*. per lb. The actual outlay on spraying may thus be estimated at about 6*d*. per 100 plants.

LIMING (O. N.). **Elm diseases in America.**—Abs. in *Phytopath.*, xxiii, 1, p. 21, 1933.

From 1930 to 1932, 1,045 out of 1,407 specimens of elm examined

at Wooster, Ohio, on account of suspected Dutch elm disease [*Ceratostomella ulmi*] showed the presence of parasitic fungi, 146 giving a *Verticillium* and 336 (?) *Cephalosporium* [*R.A.M.*, xi, p. 213; xii, p. 125]. Trees affected by the former disease in one year appear to recover, at any rate temporarily, the next season, but those attacked by *Cephalosporium* deteriorate as time advances.

SIBILIA (C.). **La resistenza dell' 'Ulmus pumila' al 'Graphium ulmi'.** [The resistance of *Ulmus pumila* to *Graphium ulmi.*] —*Boll. R. Staz. Pat. Veg.*, N.S., xii, 4, pp. 360–364, 1 fig., 1932.

In view of the suggestion that owing to the alarming spread of the disease caused by *Graphium* [*Ceratostomella*] *ulmi* the elms at present grown in Italy should be replaced by *Ulmus pumila* [*R.A.M.*, xi, p. 810], the author in the summer of 1932 conducted a series of inoculation tests on one-year-old trees of this variety transplanted to an experimental garden near Rome; control inoculations with *C. ulmi* were made simultaneously on *U. campestris*, *U. americana*, and *Acer campestre.* Three months later, examination showed that whereas the inoculations on the last-named host had given negative results all the others had been successful. On *U. pumila* the wood showed the characteristic discoloration to a distance of 8·5 cm. from the point of inoculation, mycelium identical with that found in natural infections was present in the vessels, and *C. ulmi* was re-isolated 8 cm. away from the site of inoculation. Owing to the artificial conditions of the experiment this result is not considered as definitely establishing the susceptibility of *U. pumila* to the disease.

WELCH (D. S.). **Nectria canker of Basswood.**—Abs. in *Phytopath.*, xxiii, 1, p. 36, 1933.

Basswood (*Tilia americana*) trees in central New York are seriously affected by a canker associated with a species of *Nectria*, which involved 117 out of 258 trees on two half-acre plots selected at random. The lesions are sunken in the centre and surrounded by a varying number of concentric callus rolls according to the age of the infection. Positive results were obtained in 54 out of 64 inoculation experiments on lime trees with the *Nectria*, all seven controls remaining healthy, and the same organism was repeatedly recovered from such infections 18 to 24 months after inoculation. Stromata bearing conidia and perithecia are sparsely produced at the margins of cankers on living trees. The fungus develops in profusion on living trunks that have been cut and left in the woods, and on such trees perithecia containing viable spores may be found throughout the year. Similar diseases, hitherto apparently unreported, have been found on *Acer rubrum*, *A. spicatum*, *Fraxinus nigra*, *Populus grandidentata*, *Prunus serotina*, and *Rhus typhina.*

EHRLICH (J.). **Nectria coccinea on Beech.**—Abs. in *Phytopath.*, xxiii, 1, p. 10, 1933.

Field observations, experimental work, and histological studies on the widespread and destructive disease of beeches in the

Canadian Maritime Provinces due to *Nectria coccinea* following invasion by the beech scale, *Cryptococcus fagi* [*R.A.M.*, xi, p. 410], have shown that the fungus enters the minutely fissured periderm of trunk and branches where the insect has been feeding, thence spreading rapidly through bark, phloem, cambium, and peripheral sapwood. The infected tissues are killed and the water circulation interrupted. Both the fungus and the insect are disseminated by wind, the former during and after rain. *N. coccinea* has recently been found as far south as Maine, while the insect is reported from Massachusetts.

JACKSON (L. W. R.) & HARTLEY (C.). **Transmissibility of the brooming disease of Black Locust.**—*Phytopath.*, xxiii, 1, pp. 83–90, 2 figs., 1933.

Details are given of the writers' experiments in the transmission of the brooming disease of black locust (*Robinia pseud-acacia*) [*R.A.M.*, viii, p. 537] in the District of Columbia. Successful transmission was effected by grafting diseased stem scions on to healthy stocks in 7 out of 12 cases, four of which (including one in which the scion had died) showed definite brooming of the stock for a distance of up to 3 ft. before the end of the first summer (five months after grafting). The symptoms thus induced included twig proliferation and leaf dwarfing as observed in the field. In other cases transmission experiments failed despite the union and growth of the scion. The disease is considered to be of the peach yellows type and presumably caused by a virus. Attempts to transmit the brooming disease by budding gave negative results.

JACKSON (L. W. R.). **Effects of H-ion and aluminum-ion concentrations on conifer damping-off.**—Abs. in *Phytopath.*, xxiii, 1, p. 18, 1933.

*Pseudotsuga taxifolia* and *Pinus ponderosa* seedlings were grown and inoculated with *Pythium* and *Rhizoctonia* in liquid and quartz sand cultures at a hydrogen-ion range equivalent to $P_H$ 2·5 to 8·5. A nutrient solution, stable through a wide $P_H$ range in the presence of iron and aluminium, was obtained by using disodium glycerophosphate as a phosphate source. In both liquid and sand cultures without aluminium, damping-off percentages increased from 0 at $P_H$ 2·5 to a maximum near the neutral point. In sand cultures the addition of aluminium sulphate apparently caused a decrease of damping-off at $P_H$ 3·5 but not at 6·5 [*R.A.M.*, xii, p. 269]. The growth of several *Pythium* isolations from both acid and alkaline soils was inhibited below $P_H$ 3·5, while it increased from 4·5 to 6·5 and then declined almost to cessation at 8·5. *Rhizoctonia* gave an appreciable growth at $P_H$ 3·5.

BROWN (J. G.) & EVANS (M. M.). **Crown gall on a conifer.**—*Phytopath.*, xxiii, 1, pp. 97–101, 2 figs., 1933.

The roots of a *Cupressus arizonica* tree at the Arizona University, Tucson, were recently observed to bear galls up to 9 in. in diameter resembling those caused by *Phytomonas* [*Bacterium*] *tumefaciens*, an organism apparently identical with which was

isolated on Patel's medium [*R.A.M.*, vi, p. 19] from the diseased material and inoculated with positive results into castor bean (*Ricinus communis*). Apart from a record by Miles and Brown (*Plant Disease Reporter Suppt.* 81, p. 133, 1931) of crown gall on *Juniperus sabina*, the present is believed to be the first report of the occurrence of the disease on a conifer.

LIESE (J.). **Die Douglasiennadelschütte und die Möglichkeit ihrer Bekämpfung.** [The leaf fall of Douglas Firs and the possibility of its control.]—*Mitt. Deutsch. Dendrol. Gesellsch.*, *1932*, xliv (*Jahrb.*), pp. 294–304, 2 pl., 1932.

The available information on leaf fall [*Rhabdocline pseudotsugae*] of Douglas firs [*Pseudotsuga taxifolia*] is summarized, with special reference to its effects on German silviculture and to the possibilities of its control [*R.A.M.*, xii, p. 255].

SOLOVIEFF (F. A.). Пузырчатая ржавчина Сосны (**Peridermium pini Wallr. var. corticola Rabh.**). (Фитопатологическое исследование). [Blister rust (*Peridermium pini* Wallr. var. *corticola* Rabh.) of the Pine. (Phytopathological investigation).]—*Mitt. der Forstl. Versuchsanst.*, Leningrad, vi, 1, pp. 3–44, 4 figs., 9 graphs, 1929. [German summary. Received March, 1933.]

The phytopathological survey in 1926 and 1927 of two extensive forestry estates (consisting mainly of *Pinus sylvestris*) in north-western Russia showed the considerable prevalence there of blister rust, presumably *Peridermium pini* var. *corticola*, since its transmission from pine to pine was established [*R.A.M.*, iv, p. 376; ix, p. 691]. The incidence of the rust was greatest (up to 26 per cent.) in the pure pine stands (of the Pinetum vacciniosum and P. cladinosum types), and least (5 per cent.) in the mixed pine and fir stands. In the first, infections occurred on trees of all ages between 43 and 143 years, but their maximum number was found on 60-year-old trees; initial infection had occurred only on wood between 15 and 63 years old. The maximum duration of the disease observed was 88 years in a 170-year-old tree, and 29 years in an 80-year-old stand. A single tree may bear as many as five distinct lesions, the average length of which is 1·5 m. with a maximum of up to 5 m. About 67 per cent. of the lesions observed were on the side of the tree facing south, indicating, in the author's opinion, marked phototropism in the fungus. The average annual rate of spread of the lesions was about 10 cm. up and down and 1·5 to 2 cm. laterally from the centre of attack. The largest number of trunks bearing lesions was in the dominant classes of the trees in a stand, while the largest number of trees killed by the rust was in the suppressed classes. The disease has, however, a very depressing effect on the growth of the affected trees, and the latter are gradually transferred from the dominant to the suppressed category. Particularly when the lesions are situated rather low down on the trunk, the trees are killed standing, the whole duration of the disease depending largely on the initial vigour of the individual tree and on the environmental conditions. The rust is further important in that, as shown by the data collected,

the annual increment in the volume of useful timber of the affected trees is only about two-fifths that of the healthy ones. The only control measure recommended is the felling and removal of diseased trees, and a schedule is worked out for the practical application of this measure in stands showing various degrees of intensity and severity of attack.

The effect of the disease on the technical properties of pine wood is discussed in some detail. It is pointed out that affected timber is very rich in resin, this considerably increasing its value as fuel, and rendering it very profitable for the distillation of tar.

MIELKE (J. L.) & HANSBROUGH (J. R.). **Susceptibility to blister rust of the two principal Ribes associates of Sugar Pine.**—*Journ. of Forestry*, xxxi, 1, pp. 29–33, 1933.

For three years (1930–2) the writers made observations on the susceptibility to white pine blister rust (*Cronartium ribicola*) of the two principal *Ribes* associates of sugar pine (*Pinus lambertiana*) in California, viz., *R. roezli* and *R. nevadense*, about 100 of each of which species were transferred to Owl Creek and D'Arcy, British Columbia, together with 75 of *R. sanguineum* and 69 of *R. lacustre* for comparison [*R.A.M.*, xii, p. 341]. Both *R. roezli* and *R. nevadense* proved to be highly susceptible to the rust, the former being defoliated before teleutospores could be produced in any numbers while the latter formed these organs in profusion. *R. sanguineum* was moderate both in susceptibility and teleutospore production, while *R. lacustre* is generally fairly resistant and forms relatively few teleutospores.

LINDGREN (R. M.) & CHAPMAN (A. D.). **Field inoculations of Pinus strobus with sporidia of Cronartium ribicola in Minnesota.**—*Phytopath.*, xxiii, 1, pp. 105–107, 1933.

In the summer of 1927 a number of field inoculations were made with sporidia of *Cronartium ribicola* on three- to seven-year-old *Pinus strobus* trees in two localities in Minnesota, the inoculum consisting of teleutosorus-bearing leaves of *Ribes nigrum* and *R. cynosbati* [cf. preceding abstract]. The methods were substantially the same as those of Snell and Gravatt [*R.A.M.*, v, p. 262], except that the 'iceless refrigerator' was replaced by wet sphagnum moss round the base of each pine, the entire plant being covered with a large can around which wet sacking and moss were placed. Under these conditions the temperature during incubation ranged from 57° to 76° F.

Of the nine trees inoculated with sporidia from *R. nigrum* at Rush Lake, eight showed definite symptoms of infection in November, 1929, while at Afton, where the inoculum originated on *R. cynosbati*, only one developed blister rust. Even allowing for the fact that conditions in the former locality were more favourable for infection, it seems reasonable to suppose that there is an actual difference in potency between the sporidia of the rust from the two currant hosts.

GILGUT (C. J.) & BOYD (O. C.). **Cytospora canker of Picea spp.**—Abs. in *Phytopath.*, xxiii, 1, p. 11, 1933.

Blue spruce (*Picea pungens* [var.] *glauca*) and to a lesser extent

Norway spruce (*P. excelsa*) have long suffered from a die-back of the lower limbs in Massachusetts. In 1923 a limb canker of unknown cause was reported on *P.* sp. from Connecticut. A species of *Cytospora* was found constantly associated with the cankers in Massachusetts in 1930, and was also recorded in the same year on *P. pungens* [var.] *kosteri* in New Jersey. From a quarter to half the limbs of blue spruce may be affected by the fungus, which generally starts on a lower limb and spreads upwards and laterally, producing extensive gummosis in most cases. Spring inoculations with pure cultures of the *Cytospora* from blue spruce resulted in typical limb cankers by the autumn, with pycnidial formation, gummosis, and death of limbs both on blue and Norway spruces. The organism was re-isolated in pure culture.

WATERMAN (ALMA M.) & MCKENZIE (M. A.). **A disease of Colorado Fir.**—*Phytopath.*, xxiii, 1, pp. 108–109, 1933.

About 500 Colorado fir (*Abies concolor*) trees in eastern Massachusetts were attacked in 1931 by *Rehmiellopsis bohemica*, previously reported by Bubák on *A. pectinata* in Czecho-Slovakia (*Naturw. Zeitschr. Forst. u. Landw.*, viii, p. 313, 1910) and subsequently found in Scotland [*R.A.M.*, vi, p. 446], where *A. nobilis*, *A. pinsapo*, *A. cephalonica*, and *A. pindrow* were also attacked. This is believed to be the first report of the fungus in the United States, and of *A. concolor* as a host.

The needles of the new growth turned reddish, then brown to black, and persisted for some time in a shrivelled condition on the twigs. By midsummer some of the diseased needles had been replaced by a stunted second growth but this was absent on other twigs which were blackened and malformed. The lower branches were most severely affected. The following year the new growth from the uninfected and relatively uninjured twigs soon developed yellow diseased areas, especially on the needles in proximity to those bearing perithecia from the previous season.

The morphological characters of the fungus are briefly described. No pycnidial stage such as reported in Europe has been definitely identified in the material collected.

Sections through the blackened twigs bearing diseased needles collected in the spring show abundant mycelium in the leaf cushions. The hyphae penetrate between the cell walls, their advance being preceded by a brownish discoloration and thickening of the latter, accompanied by distortion of the cells and excessive resin production.

GROSMANN (HELENE). **Über die systematischen Beziehungen der Gattung Leptographium Lagerberg et Melin zur Gattung Ceratostomella Sacc. nebst einigen Bemerkungen über Scopularia venusta Preuss und Hantzschia phycomyces Awd.** [On the systematic relations of the genus *Leptographium* Lagerberg & Melin to the genus *Ceratostomella* Sacc., with some observations on *Scopularia venusta* Preuss and *Hantzschia phycomyces* Awd.]—*Hedwigia*, lxxii, 6, pp. 183–194, 8 figs., 1932.

After recapitulating her account of the association of *Lepto-*

*graphium penicillatum* with bark beetles (*Ips typographus* and *Pityogenes chalcographus*) in spruce (*Picea excelsa*) wood in Switzerland [*R.A.M.*, x, p. 564], the writer states that the long-necked, black perithecia characteristic of *Ceratostomella* developed after four to six weeks in cultures on spruce bark and also on malt-meat extract-agar with tannin. The perithecia measured 850 $\mu$ in height and contained mucilaginous asci with eight hyaline, oval or slightly curved ascospores, 6·5 by 2·3 $\mu$, monospore cultures of which in their turn yielded the conidial stage of the fungus already described. The genetic connexion between the *Leptographium* and the *Ceratostomella* stages is thus established, the latter being named *C. penicillata* Grosmann, with a Latin diagnosis.

There is a possibility that *Scopularia venusta*, originally observed by Preuss in 1851 causing a blue discoloration of pine wood [cf. ibid., ix, p. 77], may be the same as *C. penicillata*, but the fungus has not been found since and its identity must remain doubtful though Preuss's figure in the main closely resembles the conidial stage of *C. penicillata*. *Hantzschia phycomyces* Awd., subsequently transferred by Saccardo to *Graphium* as *G. phycomyces*, is practically identical with *L. penicillatum* except for the shape and size of its conidia (oval, 3 to 4 $\mu$ in diameter), and is renamed *L. phycomyces* (Awd.) Grosmann.

KÜSTER (E.). **Hexenbesen an der Fichte.** [Witches' brooms on the Spruce.]—*Mitt. Deutsch. Dendrol. Gesellsch., 1932*, xliv (*Jahrb.*), pp. 305–306, 1 pl., 1932.

A description is given of a witches' broom observed on a spruce (*Picea excelsa*) tree 20 m. in height near Giessen, Germany. The 13-year-old structure measured 140 cm. in width at the base and 120 cm. in height, its shape being approximately spherical. The colour and anatomy of the needles in the witches' broom were normal but they were markedly shortened. The growth of the branches was compressed and red wood formation was conspicuous. The leaf bases were prominently developed, imparting a roughness to the surface of the branch. The scaly leaves were largely retained by the branches constituting the broom. Cones were formed only on the branches in the interior of the broom; the scales of which they consisted were small, rhomboid, and irregularly bent. Bud mutation is believed to be responsible for the development of witches' brooms of this type, which are stated to be prevalent in the Lahn Valley.

KAUFERT (F. H.). **Fire and decay injury in the southern bottomland hardwoods.**—*Journ. of Forestry*, xxxi, 1, pp. 64–67, 1933.

The writer has made a study of decay by wood-rotting fungi among the fire-scarred bottomland hardwoods in Louisiana. It was found that a high proportion (estimated at 90 to 95 per cent.) of the mature trees had been severely damaged by rots gaining entrance through fire wounds, while immature timber had apparently been even more extensively injured. Thus, in a 70-year-old oak stand of 261 trees examined in 1931, 47 per cent. had been

fire-scarred within the last 20 years and all showed some decay, extending on the average 4 to 6 ft. up the trunk; the merchantable product was reduced by some 14 per cent. in volume. In a tract of virgin red gum [*Liquidambar styraciflua*] a 12 per cent. loss was recorded. About 70 per cent. of young hardwoods injured by fire in 1924–5 showed considerable decay in 1931. Fire scars heal very slowly and have been found still open 15 to 20 years after formation.

PILÁT (A.). **Eine interessante Pilzinfektion des Weinberger Tunnels in Prag.** [An interesting fungus infection of the Weinberg tunnel in Prague.]—*Ann. Mycol.*, xxxi, 1–2, pp. 59–72, 1933.

Attention is drawn to the occurrence in the Weinberg tunnel leading out of the Wilson station in Prague, of the fungus *Leptoporus undatus* (Pers.) Pilát n. comb. (syn. *Polyporus undatus*, *Poria undata* [*R.A.M.*, v, p. 588], *L. broomei*, etc.), the very variable fruit bodies of which (described under various forms) are scattered in hundreds over the arch and walls. The growth in places covered more than two sq. m. of surface and protruded from between the stones constituting the tunnel lining, its connexion with wood being often not obvious. It is believed to have originated mostly from the remains of the props left behind the walls when the tunnel was constructed 60 years ago. The fungus, which has also been found in Czecho-Slovakian mines, is believed to have been present in the tunnel in a latent form until the recent electrification of the railway, its development being checked by the disinfectant action of the smoke from the steam trains, while a heavy coating of soot excluded air from the cracks in the structure. The present conditions evidently favour the development of *L. undatus*, which is further promoted by the extreme humidity of the atmosphere. The rot of the medullary rays induced by this organism is of the honeycomb type; the wood turns reddish-brown and is eventually converted into a pulpy mass. The hyphae of the fungus were found to penetrate the most minute interstices of the structure, destroying the mortar both by mechanical and chemical means, the latter involving the destruction of the lime by its conversion into calcium oxalate crystals. The writer does not anticipate extensive damage to the tunnel from the invasion of *L. undatus*, the removal of which would in any case be impossible while its present substratum lasts. The advantages of disinfection are very problematical owing to the great resistance of the hyphae to toxic agents, and the substitution of some inorganic material for wood props in future constructions of the kind is recommended.

LINDGREN (R. M.). **Decay of wood and growth of some Hymenomycetes as affected by temperature.**—*Phytopath.*, xxiii, 1, pp. 73–81, 2 graphs, 1933.

The effect of temperature on the rate of wood decay and of mycelial growth on culture media was studied at Minnesota University under controlled conditions with three wood-destroying

fungi, viz., *Lenzites sepiaria, Polystictus versicolor*, and *Lentinus tigrinus*. The cardinal temperatures for growth on malt extract agar were found to be as follows: *L. tigrinus*, minimum, optimum, and maximum 7°, 32° to 35°, and 43° C., respectively; *P. versicolor*, 0°, 27° to 32°, and 40°; *Lenzites sepiaria*, 5°, 32° to 35°, and 45° [cf. *R.A.M.*, x, p. 572].

Blocks of *Pinus resinosa, Picea glauca, Betula papyrifera*, and *Populus tremuloides* wood (112 in all) were autoclaved for 30 minutes at 15 lb. pressure, a block of each species being then transferred to jars containing pure cultures of each fungus which were placed in incubators maintained at constant temperatures of 22°, 27°, 32°, and 35°. The decay caused by *L. sepiaria* and *P. versicolor* progressed most rapidly at the temperatures favouring their mycelial growth, while the rot due to *Lentinus tigrinus* was most active at 27°. Both mycelial growth and decay processes were substantially retarded for all three organisms at 22°.

The temperature relations of wood-destroying fungi are generally studied only in culture, on the assumption that their behaviour in nature can be predicted on this basis. For all practical purposes this supposition is probably correct, but it is conceivable that the chemical and physical differences between the natural and artificial substrata may induce corresponding alterations in the fungi concerned. Another difficulty in predicting the rate of wood decay at various temperatures from agar tests lies in the time factor, the culture experiments covering relatively short periods while the rotting of wood requires protracted exposure. It is advisable, therefore, that tests on agar should be correlated with studies on the decay of the natural substrata of the wood-rotting fungi.

LINDGREN (R. M.), SCHEFFER (T. C.), & CHAPMAN (A. D.). **Tests of chemical treatments for control of sap stain and mold in southern lumber.**—*Indus. & Engin. Chem.*, xxv, 1, pp. 72–75, 1933.

A fully tabulated account is given of the writers' experiments in Louisiana with about 100 chemical treatments for the control of sap stain (*Ceratostomella* spp.) and mould in pine [*Pinus palustris*] and hardwoods, e.g., sap gum [*Liquidambar styraciflua*], the essential features of which have been already noticed from another source [*R.A.M.*, xii, p. 344].

ROUTALA (O.) & KUULA (O.). **Eine neue Holzimprägnierungsmethode.** [A new method of wood preservation.]—*Acta Chem. Fenn.*, v, pp. 107–112, 1932. [Abs. in *Chem. Zentralbl.*, civ, 7, p. 1221, 1933.]

At the Helsingfors (Finland) Technical Institute wood was impregnated with furfural or formaldehyde and phenol and then heated under pressure with ammonia gas for one to two hours. Resin-like condensation products developed in the wood and prevented the entrance of water, the penetration of which during two hours was reduced from 34·4 to 0·8 per cent. Thus, the requirements of fungi and bacteria as regards water supply are not fulfilled by the treated wood.

GIBBS (J. G.). **Club-root of Brassicas. Experiments on disinfection of seed-beds.**—*New Zealand Journ. of Sci. & Techn.*, xiv, 3, pp. 145–151, 1932.

Of 89 treatments applied to the soil of swede seed-beds at Palmerston North, New Zealand, for the control of finger-and-toe (*Plasmodiophora brassicae*) [*R.A.M.*, xi, p. 555], only seven gave satisfactory control of the disease without adversely affecting plant growth, viz., slaked lime (30 or 60 cwt. per acre), acidulated mercuric chloride (0·1 and 0·2 per cent. containing 0·25 and 0·5 per cent. hydrochloric acid, respectively [ibid., xi, p. 260]), 0·1 per cent. mercuric chloride, and semesan (0·5 per cent. solution or as a dust at the rate of 5 oz. per sq. yd.). The cost of the treatments ranged from under one penny per sq. yd. for 45 cwt. of lime per acre (1 lb. per sq. yd.) to 1*s*. 4·8*d*. per sq. yd. for 2 galls. of 0·5 per cent. semesan per sq. yd. The acidulated mercuric chloride treatment, which is recommended by the writer for practical use, costs 2·6*d*. per sq. yd.

BROWN (J. G.) & EVANS (M. M.). **Diseases of Peas in Arizona.**—*Arizona Agric. Exper. Stat. Bull.* 142, 78 pp., 17 figs., 1933.

Popular notes are given on the symptoms, cause, and control of the following diseases of peas in Arizona: powdery mildew (*Erysiphe polygoni*) [*R.A.M.*, xi, p. 28], downy mildew (*Peronospora viciae*) [ibid., xi, p. 75], a *Fusarium* foot rot believed to be due to a variety of *F. merismoides* [ibid., xii, p. 263], *Rhizoctonia* [*Corticium*] *solani*, Texas root rot (*Phymatotrichum omnivorum*), bacterial blight (*Phytomonas* [*Pseudomonas*] *pisi*) [loc. cit.], and the injuries caused by drought, soil alkalinity, and hail. The paper concludes with a summary in which the main facts relating to each disease are conveniently tabulated, and there is a bibliography of 18 titles.

WALKER (J. C.). **Comparative studies of Peas resistant and susceptible to Fusarium wilt.**—Abs. in *Phytopath.*, xxiii, 1, p. 36, 1933.

Alaska pea plants of strains resistant and susceptible to the causal organism of wilt, *Fusarium orthoceras* var. *pisi* [*R.A.M.*, xii, p. 71], were grown for varying periods at about 15° C. in Tottingham's solution, to which 1 per cent. dextrose was added on the removal of the plants. The fungus was then grown on aliquot portions of the autoclaved solution. A consistently heavier growth was observed in the solution in which the susceptible roots had grown. In autoclaved extracts from fresh susceptible roots there was a slightly heavier growth than in those from resistant ones, and a similar slight difference was detected in extracts from air-dried roots. In extracts from roots dried at 85° C. there was a markedly heavier growth in those from susceptible ones.

HEIMBECK (LOUISE S.). **Seed-borne bacteria main cause of Pea wilt; Fusarium, Aphanomyces, and other organisms merely subsidiary.**—Abs. in *Phytopath.*, xxiii, 1, p. 14, 1933.

Pea wilt is stated to be best studied on peas grown in water

cultures, in which fatty substances oxidize slowly, so that the cell walls of the roots are easily penetrated by the bacteria, which gain access to the vascular core chiefly through endodermal openings formed by secondary rootlets. The host cells react to invasion by the production of a yellowish-brown to reddish, gummy substance that conceals the bacteria except in stained microtome sections. The bacteria may reach the growing pod and enter the ovule, without, however, preventing its development into a viable seed. Seedlings originating from infected seed show vascular discolorations in the cotyledon petioles, epicotyl, or root, but under favourable growing conditions and in the absence of such secondary parasites as *Aphanomyces* [*euteiches*: see next abstract] or *Fusarium* [see preceding abstracts] they may grow into apparently healthy plants.

WALKER (J. C.). **Relation of soil fertility to incidence of Aphanomyces root rot of Pea.**—Abs. in *Phytopath.*, xxiii, 1, p. 36, 1933.

Colby silt loam is stated to be one of the most favourable Wisconsin soils for the development of the pea root rot due to *Aphanomyces* [*euteiches*: *R.A.M.*, xi, p. 626]. All the eight canning varieties tested in the greenhouse on this type of soil from a heavily infested field were severely damaged by the disease, which underwent a marked decline on the addition to a portion of the soil of a 500 lb. application of 4–16–4 fertilizer. In the Alaska variety the incidence of infection was reduced from between 63 and 100 per cent. on the unfertilized to between 3 and 20 per cent. on the fertilized soil, while similar reactions were displayed by the Surprise, Bruce, Admiral, Ashford, Perfection, Prince of Wales, and Wisconsin Early Sweet varieties.

SAVASTANO (G.). **Il mosaico del Fagiolo in Italia.** [Bean mosaic in Italy.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 4, pp. 377–394, 4 pl., 3 figs., 1932.

In this account of the geographical distribution, symptoms, probable nature of the virus, and different types of bean mosaic [*R.A.M.*, vii, pp. 108, 134; xii, p. 204] the author states that beans [*Phaseolus vulgaris*] of numerous varieties growing near Rome were recently affected. Rubbing healthy leaves with diseased tissues in a few instances caused incipient pock marking, and three out of thirty seedlings raised from seed obtained from affected plants, the seedlings being protected from insect infestation, developed definite mosaic [ibid., vii, p. 658]. Early in the autumn many of the originally affected beans showed only faint traces of mosaic, the masking being due to the seasonal drop in the temperature [ibid., ix, p. 755]. Reference is made to the discovery of resistant varieties in America and Germany [ibid., ix, p. 561] and it is stated that Robust seed obtained from Michigan is to be tested for suitability to Italian conditions. The paper concludes with brief recommendations for control, and there is a bibliography of 18 titles.

ZAUMEYER (W. J.). **Transmission of Bean-mosaic virus by insects.**—Abs. in *Phytopath.*, xxiii, 1, p. 40, 1933.

Insect population studies in the bean [*Phaseolus vulgaris*] fields of Colorado, Idaho, and Virginia have shown that, of the many species present, aphids alone are capable of mosaic transmission [see preceding and next abstracts]. Under controlled greenhouse conditions, the virus has been transmitted by feeding virus-free aphids on diseased beans for 24 to 30 hours and then transferring them to healthy plants. Besides the potato aphid (*Illinoia solanifolii*) [*Macrosiphum gei*], the bean aphid (*Aphis rumicis*), and the peach aphid (*Myzus persicae*), already known as vectors [*R.A.M.*, ix, p. 756], the following will also transmit the virus: the pea aphid (*I.* [*Macrosiphum*] *pisi*), the cucumber aphid (*A. gossypii*), the cabbage aphid (*Brevicoryne brassicae*), the *Chenopodium* aphid (*Hyalopterus atriplicis*), and an aphid, *M. ambrosia*, common on wild Compositae. All except the last-named have been found on beans in the field.

ZAUMEYER (W. J.). **Transmission of certain legume-mosaic viruses to Bean.**—Abs. in *Phytopath.*, xxiii, 1, p. 39, 1933.

Cross-inoculation experiments have shown that the viruses causing mosaic of white and yellow sweet clover (*Melilotus alba* and *M. officinalis*), and white and alsike clover (*Trifolium repens* and *T. hybridum*) are transmissible to beans [*Phaseolus vulgaris*]. The *M. alba* mosaic virus produced symptoms on beans differing only slightly from those of the common bean mosaic [see preceding abstracts], and it is thought possible that some of the secondary spread of the latter in the field may be due to aphid transmission of the white sweet clover virus. The pea and sweet pea (*Lathyrus odoratus*) mosaic viruses [ibid., vi, p. 469; x, p. 78; xi, p. 759] also gave positive results on inoculation into beans, either by means of expressed juice from diseased plants or by the pea aphid, *Illinoia* [*Macrosiphum*] *pisi*.

NELSON (R. E.) & DOWN (E. E.). **Influence of pollen and ovule infection in seed transmission of Bean mosaic.**—Abs. in *Phytopath.*, xxiii, 1, p. 25, 1933.

To test the possibility of bean [*Phaseolus vulgaris*] pollen infection by mosaic [see preceding abstracts], and to determine the relative effects of pollen and ovule infection in seed transmission of the disease, crosses were made between the two highly susceptible Refugee and Early Prolific varieties. The incidence of mosaic in hybrids between diseased Refugee and healthy Early Prolific was about the same as in those between healthy Refugee and diseased Early Prolific. The data indicate that about a quarter of the ovules and pollen grains are infected. In crosses between Refugee and Robust, a highly resistant variety, about a quarter of the hybrid seedlings showed severe mosaic infection.

ADAM (D. B.). **Bacterial blight of Beans.**—*Journ. Dept. Agric. Victoria*, xxxi, 1, pp. 1–4, 3 figs., 1933.

After stating that French beans [*Phaseolus vulgaris*] in Victoria

became rather widely attacked two or three years ago by bacterial blight [*Bacterium phaseoli*: *R.A.M.*, x, p. 6; xi, p. 222; xii, p. 1], probably present locally in a mild form for some years, the author gives a brief account in popular terms of the manner of attack and symptoms of the disease.

Spread is favoured principally by wet, windy weather, and as this becomes less frequent as summer approaches the beans should, whenever possible, be planted later than has hitherto been customary in Victoria. The disease does not become established in areas watered only by irrigation. Losses can also be reduced by selecting for the early plantings sites sheltered from wet winds, keeping the more exposed fields for the later crops. Light sandy soil is more conducive to attack than flat river land. Sulphate of ammonia and similar fertilizers did not reduce blight in tests carried out in 1932.

Canadian Wonder beans are highly susceptible, but some of the 'fancy' varieties, such as Pale Dun and Feltham's Prolific, possess some degree of resistance.

To develop supplies of disease-free seed, a process which would practically eliminate the blight, the Victoria Department of Agriculture has established experimental plots in the heart of the seed-growing area at Orbost, while efforts are also being made to institute a seed certification scheme. Already many growers are taking every precaution at present available to secure clean crops.

PERSON (L. H.). **A bacterial blight of the Broad Bean in Louisiana.**—Abs. in *Phytopath.*, xxiii, 1, p. 27, 1933.

Broad beans [*Vicia faba*] were severely attacked in 1932 by a blight causing the development on the leaves of circular, dark-brown to black spots, 2 to 5 mm. in diameter, which usually coalesced and killed the affected foliage. A bacterium isolated from these spots produced a typical streak disease on inoculation into healthy stems, the streaks extending up to an inch from the point of inoculation, while leaves painted with a water suspension of the organism showed dark, circular areas resembling those observed in nature. Apparently this is the first record of a bacterial blight of broad beans in the United States, and it is not yet known whether it corresponds to that occurring in Europe [? *Bacillus lathyri*: *R.A.M.*, xi, pp. 143, 555].

WINGARD (S. A.). **Nature of rust resistance in Beans.**—Abs. in *Phytopath.*, xxiii, 1, p. 38, 1933.

Bean [*Phaseolus vulgaris*] varieties may be grouped in three classes on the basis of their reaction to rust [*Uromyces appendiculatus*: *R.A.M.*, xi, p. 284], viz., (1) immune; (2) those showing severe flecking as a result of infection; and (3) those on which numerous sori are produced. The flecking varieties are hypersensitive, the tissues being killed immediately the fungus enters the leaf. In the third group there is some evidence of a preservative action towards the host on the part of the fungus, as shown by the persistence of the chlorophyll in the region surrounding the sorus after the death of the rest of the leaf.

SCHMIDT (E. W.). **Zwei seltene Rübenschädlinge.** [Two rare Beet pests.]—*Die Deutsche Zuckerind.*, lviii, 1, pp. 17–18, 6 figs., 1933.

From the Cordova district of Spain the writer received a decayed sugar beet from which he isolated the fungus *Typhula variabilis*, first studied by Prillieux in 1895 in diseased sugar beets, also from Spain, and in 1906 reported by Brizi from Cremona, Italy [cf. *R.A.M.*, viii, p. 597]. Inoculation experiments on greenhouse beets gave positive results, but the fungus has not been observed under field conditions in Germany where the soil is apparently not sufficiently warm to admit of its development. The organism causes complete rotting of the beets in a few weeks, forming thick, white strands of woven hyphae in the soil and round the root, while on the surface of the beet the sclerotia are produced and persist for months in the soil pending their development into mycelium. Clavate basidia with basidiospores have been obtained in culture.

BENLLOCH (M.). **La Cercospora de la Remolacha.** [The *Cercospora* of the Beet.]—*Bol. Pat. Veg. y Ent. Agric.*, vi (*1931*), 23–26, pp. 153–161, 10 figs., 1932.

An account is given of the leaf spot of beets (*Cercospora beticola*) in Spain, with notes on its control by three to seven applications of 2 per cent. Bordeaux or 1 per cent. Burgundy mixture with the addition of 60 gm. calcium caseinate per hectol. [*R.A.M.*, xii, p. 349].

FELIX (E. L.). **Disease resistance in Allium fistulosum L.**—*Phytopath.*, xxiii, 1, pp. 109–110, 1933.

In experiments at Elba, New York, the incidence of smut (*Urocystis cepulae*) infection in the Winterhecke onion (*Allium fistulosum*) frequently averaged 10 to 20 per cent. in the cotyledonous stage, but always fell to 0·5 or less per cent. in later counts. This variety is synonymous with White Welsh (Ciboule blanche or Ciboule d'hiver) and very similar to a number of Japanese varieties showing a high degree of resistance [cf. *R.A.M.*, v, p. 205]. Another strain of *A. fistulosum*, known as *A. moly*, proved more susceptible to smut (45 per cent.). The Winterhecke, White Welsh, and Nebuka strains were also found to be resistant to pink root (*Phoma terrestris*) [ibid., xi, p. 162], while the first-named further appeared to suffer little damage from mildew (*Peronospora schleideni*) [ibid., xi, p. 689].

NELSON (R.) & COCHRAN (L. C.). **Breeding Fusarium yellows-resistant Celery.**—Abs. in *Phytopath.*, xxiii, 1, p. 25, 1933.

Commercial tall-strain celery varieties, e.g., Golden Self Blanching, have suffered increasingly in Michigan during the past five years from yellows (*Fusarium* sp.) [*R.A.M.*, viii, p. 22], the losses from which in 1931 amounted to $250,000. The short-strain varieties, such as Golden Plume, show a fair degree of resistance under normal conditions. The $F_1$ and $F_2$ progenies of a selection from a susceptible tall strain have shown marked resistance in field and greenhouse tests under the most favourable conditions for yellows. The plants of the new variety, known as Michigan

Golden, are intermediate in type between the tall and short strains and appear to possess desirable commercial qualities.

COOK (H. T.). **Infection of seed clusters of Spinach by Peronospora effusa.**—Abs. in *Phytopath.*, xxiii, 1, p. 7, 1933.

The seed clusters of spinach seed plants at the Virginia Truck Experiment Station were found to bear conidia and conidiophores of *Peronospora effusa* [*R.A.M.*, xi, p. 420] in 1930 and 1932. Sections of the diseased fruit showed that the mycelium of the fungus had permeated the pericarp, funiculus, and the integuments of the ovule. Oospores were found in profusion in the infected leaves but not in the seeds of the same plants. Possibly the introduction of *P. effusa* into new areas may be effected to some extent by means of the seed.

JAGGER (I. C.) & CHANDLER (N.). **Physiologic forms of Bremia lactucae on Lettuce.**—Abs. in *Phytopath.*, xxiii, 1, pp. 18–19, 1933.

In breeding lettuce for resistance to mildew (*Bremia lactucae*) [*R.A.M.*, xi, p. 491], several apparently distinct physiologic forms of the fungus have been detected. In 1922 nine lettuce varieties showed a high degree of resistance in trials in Florida, and the same varieties behaved similarly in succeeding years at Chula Vista, California. In 1926 only two of these varieties showed marked resistance in England to the apparently distinct form of the mildew occurring there. In 1927 three varieties proved highly resistant to a third physiologic form then prevalent in Imperial Valley, California. The French variety Romaine blonde lente à monter has hitherto shown considerable resistance to all forms of *B. lactucae* encountered. Crosses between this variety and New York or Iceberg have given several highly resistant strains at Chula Vista. In central California there seems to be a fourth form of mildew capable of attacking these hybrids, but from which the 'Imperial D' strain is practically immune.

KORDES (H.). **'Sclerotinia-Welke' der Treibhausgurken.** [*Sclerotinia* wilt of glasshouse Cucumbers.]—*Obst- und Gemüsebau*, lxxix, 1, p. 5, 2 figs., 1933.

A popular note is given on the occurrence and control of cucumber *Sclerotinia* wilt (*S. sclerotiorum*) in Germany [*R.A.M.*, xi, p. 620]. The fungus attacks the cortex and vascular bundles of the stem base (up to a height of 10 cm. from the ground), causing a rapid wilting. Young fruits are also liable to infection. The diseased areas of the stem should be excised and the wounds painted with tree wax, and after the harvest the houses should be sprayed with 1 per cent. formalin before renewing the compost.

NICOLAS (G.) & AGGÉRY (B.). **Remarques sur Gloeosporium lagenarium (Passer.) Sacc. et Roum. et Colletotrichum oligochaetum Cav. et sur leur mode de conservation.** [Observations on *Gloeosporium lagenarium* (Passer.) Sacc. & Roum.

and *Colletotrichum oligochaetum* Cav. and on their mode of perpetuation.]—*Comptes rendus Soc. de Biol.*, cxii, 2, pp. 125–126, 1933.

Watermelons from the vicinity of Toulouse were observed, in October, 1932, to bear acervuli typical of *Gloeosporium lagenarium* (without setae) as well as those of *Colletotrichum oligochaetum* (with setae) [*R.A.M.*, x, p. 772]. The examination of a melon similarly infected also showed both types of acervuli, which evidently belong to the same fungus; the black setae are apparently characteristic of the later stages of attack, when the parasite has ruptured the epidermis. In the writers' opinion, *G. orbiculare* and *G. cucurbitarum* should also be referred to *G. lagenarium*.

After 24 hours in water at 14° to 18° C. the conidia produce chlamydospores, which in turn form hyphae at 24° 13 days later. The perpetuation of the fungus is thought to be effected by means of these organs.

SLEETH (B.). **Relationship of Fusarium niveum to the formation of tyloses in Melon plants.**—Abs. in *Phytopath.*, xxiii, 1, p. 33, 1933.

Abundant tyloses were observed in one- to four-month-old melon plants infected by *Fusarium niveum* [*R.A.M.*, xii, p. 269], their occurrence being apparently correlated with the presence, quantity, and proximity of the fungus. Of the infected vascular bundles of the same plant, a quarter to all may be completely filled by tyloses, few or none of which are found in the healthy ones. When the mechanical obstruction of the vessels by the tyloses reaches a point sufficient to impede the normal flow of water and nutrients in the plant, stunting and wilting take place.

PETRI (L.). **Sopra la opportunità di applicare le odierne nozioni della genetica alla produzione di nuovi portinnesti per la Vite europea.** [On the opportunity of applying modern ideas of genetics to the production of new stocks for the European Vine.]—*Boll. R. Staz. Pat. Veg.*, N.S., xii, 4, pp. 343–360, 1932.

In support of his view that official encouragement should be given in Italy to the systematic production of new vine hybrids resistant to leaf roll and possessing a high grafting affinity for the native Italian vines, the author describes and discusses in detail instances in which vines grafted on American stocks (especially Riparia × Rupestris 3309, Riparia × Berlandieri 34 E.M., 420 A, 157″, and Rupestris du Lot) have, all over Italy, shown a rapid decline which takes the form of premature senility developing most often about the sixth or seventh year after grafting. The usual symptoms consist in a gradual loss of growth activity in the aerial parts, which wilt from the top downwards, and in the roots, though the latter do not rot until the two- or three-year-old wood has ceased to shoot; marked rachitism (i.e., pronounced shortening of the internodes, small leaves, false side shoots, and deficient chlorophyll in the interveinal parts of the leaf blades); and, sometimes, reddening of the leaves. The condition occurs seven or more years after grafting, on single vines and groups, and tends to spread. It may affect vines grafted four or five years earlier

while others near by of the same variety grafted on the same stock 20 years ago are still flourishing. It does not affect hybrids exclusively, nor is it due to any acquired defect in the wood of the American vines. Italian ungrafted vines are usually unaffected. That it is definitely due to some pathogenic agency is clear from the fact that it is not found uniformly on all vines of the same age in any one locality, but is sporadic, the activity of the pathogen being apparently favoured by local conditions, and also from its tendency to spread. It is presumed that the disease is due to a virus similar to but distinct from that causing leaf roll ('arricciamento' or 'court noué') [*R.A.M.*, xi, p. 21].

In this connexion, the author states that he found endocellular cordons [ibid., ix, p. 83] in the wood of vines affected with mosaic from Czecho-Slovakia [ibid., xi, p. 280], a fact already noted by Straňák, so that this disease is evidently related to leaf roll. Mosaic vines grafted on to American stocks lost their mosaic characters and acquired those of leaf roll, confirming the close affinity of the diseases. A mosaic different from that reported from Bohemia has occasionally been observed in Italy on vines affected with leaf roll. It would appear that a mosaic virus is probably present in vines at the same time as the virus causing chronic rachitism. It is, therefore, very possible that the Italian disease under consideration is due to an insect-transmitted virus and investigations have been started in order to test this explanation of the decline of the vines in reconstituted vineyards all over Italy.

Any attempt to reconstitute Italian vineyards in future must be based on a methodical study of stocks in relation to their soil and climatic requirements and their grafting affinity with Italian vines, this work being supplemented by phytopathological observation of the wilt symptoms which indicate the presence of the cause of premature senility. Other stocks than those in common use must be tested and preference should be given, for reasons which are indicated, to the European-American hybrids with one-half *Vitis vinifera* 'blood'.

DUFRÉNOY (J.). **Les contaminations successives de la Vigne par le Plasmopara viticola.** [Successive infections of the Vine by *Plasmopara viticola*.]—*Comptes rendus Soc. de Biol.*, cxii, 3, pp. 326–328, 1 graph, 1933.

In further experiments in 1932 on the lines of those carried out in 1931 [*R.A.M.*, xi, p. 422], where each successive lot of ten Cabernet vines received only one copper treatment, those sprayed on 26th May, when not more than eight leaves were developed, produced less than 50 gm. of fruit each. Those treated before flowering (27th June) gave similar but even smaller yields, although a larger number of leaves escaped infection. At the date of flowering there was a sufficient number of zoosporangia to cause infection; each vine given a single application of copper on 27th June yielded on an average $265 \pm 134$ gm. of fruit, whereas those sprayed on 29th (after rain) [ibid., xii, p. 198] produced only $85 \pm 80$ gm. A week later, when the number of zoosporangia was considerable, each vine treated on 5th July gave an average yield

of $200 \pm 80$ gm., while on those sprayed after rain two days later the grapes were totally destroyed. The average yield of the vines given nine treatments was $360 \pm 140$ gm.

ROUAYROUX (R.). **Les bouillies cupriques à l'alun.** [Cupric sprays with alum.]—*Prog. Agric. et Vitic.*, xcix, 2, pp. 36–38, 1933.

The author (who stresses the fact that he is a chemist and is not acquainted with the action of fungicidal sprays on the vine) states that the chemical and physical properties [which are briefly discussed] of the precipitate formed when alum is added to Burgundy mixture, and the fact that it contains a very appreciable quantity of free copper, would indicate the greater fungicidal efficacy and the greater adhesiveness of the Burgundy plus alum spray, and would warrant a trial of the latter for the control of vine mildew [*Plasmopara viticola*: but cf. *R.A.M.*, xii, p. 139]. In an editorial note to this paper, a warning is, however, given against too extensive preliminary trials, since the free copper in the spray may easily prove injurious to the vine.

RAVAZ (L.). **Chronique. L'excoriose.** [Current events. Excoriosis.]—*Prog. Agric. et Vitic.*, xcix, 2, pp. 29–33, 5 figs., 1933.

The author states that in the autumn of 1932 numerous French vine-growers reported the presence of pycnidia of *Phoma flaccida*, the cause of excoriosis [*R.A.M.*, xi, p. 359], on the pruning wood of their vines, this indicating a widespread outbreak of the disease of a severity comparable to that in 1924 [ibid., iv, p. 524]. Observations have shown that besides the cortical tissues, the fungus also enters the dormant buds, especially at the base of the current year's branches, and either kills them outright or only partially invades them. In the latter case, the buds very probably produce the most diseased wood during the new season. In pruning, care should be taken to choose, for forming the new shoots, branches free from infection, but where this is not possible, the further spread of the disease may be minimized by the excision of the two lowermost eyes on the shoots, this entailing a somewhat taller training of the vines.

HECTOR (G. P.). **Appendix I. Annual Report of the Economic Botanist, Bengal, for the year 1931–32.**—*Ann. Rept. Dept. of Agric. Bengal for the year 1931–32*, pp. 29–44, 1932.

The following items of phytopathological interest occur in this report. Encouraging results in the control of the betel vine [*Piper betle*] diseases caused by *Rhizoctonia*, *Phytophthora*, and *Sclerotium rolfsii* [*R.A.M.*, xi, p. 426] were given by the application of a soil disinfectant, 'kerol', to the ridges at a dilution of 1 in 800. Bordeaux mixture is ineffectual alone against *Rhizoctonia* and *S. rolfsii*, but proved useful as an adjunct to kerol. In the Bonhoogly district *Rhizoctonia* attacked the vines in a most virulent form, mortality being particularly heavy in the lines to which muriate of potash had been applied at the rate of 100 lb. per acre. Infection was arrested by treatment with kerol.

An epidemic of potato late blight (*P. infestans*) occurred in the

plains of Dinajpur and Rangpur, where spraying demonstrations with 1 per cent. Bordeaux mixture were given.

RUSSELL (T. A.). **Report of the Plant Pathologist, 1932.**—*Rept. Dept. of Agric., Bermuda, for the year 1932,* pp. 24–30, 1933.

During the period under review, blight (*Septoria apii*) destroyed one-third of the celery crop in Bermuda, and the damage caused by *Sclerotinia sclerotiorum* was almost as great on carrots, lettuces, and tomatoes. News was received from Montreal in March that two consignments of carrots from Bermuda had shown much rotting on arrival and on examination of the returned crates and of similar carrots in Bermuda, the rotting was determined to be due to *S. sclerotiorum*. Infection of tomatoes with *S. sclerotiorum* in the field always started in a leaf and passed down the petiole into the stem. Tomato fruits were generally attacked through the fruiting spur, injury taking the form of a greyish-brown rot. Cabbages in a neighbouring field were also seriously attacked.

A survey made in the field and among rejected fruit at the packing house showed that the commonest disease of green tomatoes was bacterial soft rot (*Bacillus carotovorus* or *B. aroideae*). Brown rot (*Rhizoctonia* [*Corticium*] *solani*) was also occasionally found causing a circular, dull brown, zonate spot near the blossom end.

*Gloeosporium limetticolum* was troublesome on the young shoots of limes. *Peronospora schleideni* occurred on onions grown from sets brought from Canada, the plants being so badly attacked as to be worthless.

HANSFORD (C. G.). **Annual Report of the Mycologist.**—*Ann. Rept. Dept. of Agric. Uganda, for the year ended 31st December, 1931* (Part II), pp. 59–60, 1932.

In this report [cf. *R.A.M.*, xi, p. 353] the author states that during the season 1931–2 cotton boll shedding caused by black arm disease (*Bacterium malvacearum*) [see below, p. 439] in Uganda was unimportant, and that on the whole this disease was not a major factor in limiting crop production. In an Appendix an account is given of an experiment carried out at Kampala in which 16 plots each of 121 cotton plants were sown with seed (A) untreated, (B) immersed for 15 minutes in a culture of *Bact. malvacearum*, (C) delinted in sulphuric acid for 35 minutes, washed, immersed in dilute mercuric chloride for 30 minutes, then washed again, and (D) dusted with Dupont granosan. Each treatment was applied to four sub-plots, and records were made of the crop produced by each plant. A preliminary analysis of the results indicated that estimating the amount of infection per plot by multiplying the number of infected plants by the number of days each was infected, there was significantly greater infection in plots B and less in plots C than in A or D. The disease spread from the plants showing primary infection to the surrounding ones slowly and evenly, until following a period of greater rainfall a rapid rise took place in the middle of October. The spread then became slower until it rose to a second peak in the second and third weeks of December. The direction of the spread was closely

similar to that of the flow of surface water during heavy rain, the only healthy plot remaining at the close of the experiment being one that received no rain wash from the others. The stem form of the disease rose steadily in all the plots until 9th to 21st December, when it rose rapidly in all the plots except the healthy one. By far the greater part of the stem and branch infections originated in the leaves and spread down the tissues of the petioles [ibid., xi, p. 354].

A cotton boll rot caused by *Diplodia* [*Botryodiplodia*] *theobromae* caused considerable damage in parts of Buganda Province, where the weather had been exceptionally moist. This is the first time in the author's experience that this disease has caused trouble in Uganda [cf. ibid., vii, p. 94]. Many of the infected bolls showed traces of attack by *Bact. malvacearum,* and in these the fungus was probably secondary.

In the district of Toro three- or four-year-old coffee showed a die-back characterized by a withering of the leaf edges, gradual defoliation, and abnormal young growth with shortened internodes and chlorotic, malformed, small young leaves. The lateral branches died back to the main stem in the middle of the trees, followed by the basal primaries. Finally, a small tuft of abnormal foliage remained at the top of the main stem. In some localities over 50 per cent. of the affected trees died out completely. The fine fibrous roots died off first, followed by a progressive rotting of the main roots, the damage roughly corresponding to that on the aerial parts. The bark of the dying roots was soft, pulpy, and easily stripped off. All the evidence obtained indicated that no highly pathogenic fungus was responsible.

In the Semliki Valley coffee roots bore well developed rhizomorphs of *Armillaria* [*mellea*], the trees being split into sectors exactly as occurs with tea in Ceylon [cf. ibid., x, p. 275]. This appears to be the first record of the disease on coffee in Uganda.

Sweet potato tubers were attacked by *B. theobromae, Rhizoctonia bataticola* [*Macrophomina phaseoli*], and *Fusarium* spp. Inoculations of sound tubers indicated that *B. theobromae* and *Fusarium* are wound parasites, but that *M. phaseoli* can attack sound tubers in the field.

Other records made during the period under review include *Peronospora* sp. causing defoliation and death of *Ocimum basilicum,* the introduction of which into Uganda has proved a failure owing to attack by this fungus; *Cercospora sesami* [ibid., viii, p. 200] causing a severe leaf spot of *Sesamum* [*indicum*]; a wilt of *Crotalaria striata* associated with various *Fusaria,* including *F. tracheiphilum*; and a serious leaf spot and defoliation of *Phaseolus* spp. and *Vigna* spp. caused by a *Colletotrichum* and an *Ascochyta*; in some seasons this disease is serious enough to jeopardize the cultivation of beans at Bukalasa, very little crop being produced.

Mosaic is the only disease of sugar-cane that remains of economic importance in Uganda [ibid., x, p. 298]; P.O.J. 2878 still shows promise of becoming the standard cane for the near future, and has not so far shown the undesirable characters of P.O.J. 2725 and 2727.

**Report of the West Virginia Agricultural Experiment Station for the period from July 1, 1930, to June 30, 1932.**—*West Virginia Agric. Exper. Stat. Bull.* 254, 60 pp., 6 figs., 1 map, 1932. [Received April, 1933.]

The following are among the items of phytopathological interest occurring in this report in addition to those already noticed from other sources. A comprehensive study has been made of the reaction to rust [*Gymnosporangium juniperi-virginianae*, *G. globosum*, and *G. germinale*: see below, p. 452] of 66 commercial apple varieties, some of which are practically immune and may be used in the vicinity of red cedars [*Juniperus virginiana*] without serious damage.

Overwintered apple leaves in several orchards in 1930 bore considerable quantities of *Mycosphaerella pomi*. In a series of inoculation tests on twelve apple varieties in 1931, Grimes was found to be most susceptible to infection by two species of *Penicillium* and one of *Alternaria*, followed by Delicious, Golden Delicious, McIntosh, Wealthy, and Jonathan, while York, Stayman, Winesap, and Baldwin were the most resistant. In addition to the 'papular' and 'blister' types of apple measles [ibid., xii, pp. 12, 378], a third form has been observed producing very numerous pimples, smaller than those of either of the other types, on the York, Jonathan, and Rome varieties.

In the order of excellence of finish, dry lime-sulphur was the best of the fungicides tested as substitutes for lime-sulphur in the control of apple diseases, followed by calmosul and flotation sulphur [ibid., xii, p. 29].

Data obtained in the Eastern Panhandle orchards indicate that the increased incidence of apple scald [ibid., xi, p. 659] following nitrogen fertilization may be largely due to delayed maturity of the fruit rather than to the presence of more nitrogen in the apple. Yorks picked on 6th October, 1931, scalded severely irrespective of nitration, whereas the incidence of the disease declined progressively in the fruit picked on 14th and 21st October. The amount of scald in nitrated fruit picked on 6th October was 85 per cent. compared with 83 per cent. for the untreated controls, no oiled paper being used for wrapping. On the 14th October picking the corresponding figures for wrapped nitrated fruit, unwrapped nitrated, wrapped but not nitrated, and neither nitrated nor wrapped were 22, 72, 17, and 54, respectively. On fruit picked on 21st October the unwrapped nitrated fruit showed 53 per cent. scald and the unwrapped and untreated 33.

The pathogenicity to watermelon of 23 collections of *Fusarium niveum* [ibid., xii, p. 269] from different parts of the United States was found to vary with the constitution of the host, but all the varieties and hybrids tested showed some degree of susceptibility to the most virulent forms of the wilt organism. From wilted plants growing in separate boxes of soil infested with individual collections, dissociants were recovered which were identical in two cases with those already obtained in the cultures. Evidently, therefore, dissociation may occur in the soil and is presumably a common feature of the wilt fungus. Cuttings placed in a filtrate of *F. niveum* wilted in eight hours when exposed in the laboratory

but showed no such effect when kept under a bell jar. The $F_2$ progeny of crosses between an inedible, wilt-resistant Russian watermelon and the edible, susceptible Early Fordhook and Grey Monarch varieties show a wide range of susceptibility to *F. niveum* and of palatability.

The *Nectria* which causes black walnut [*Juglans nigra*] canker [ibid., xi, p. 551] has been found to be closely related to *N. galligena*. A similar canker has been observed on butternut [*J. cinerea*] and certain exotic species of *Juglans*, but the *Nectria* from these hosts is not pathogenic to *J. nigra*. Conversely, the fungus from the latter does not infect butternut or black oak [*Quercus nigra*], another host of a very similar *Nectria* canker.

**Biennial Report, Utah Agricultural Experiment Station, July 1, 1930, to June 30, 1932.**—*Utah Agric. Exper. Stat. Bull.* 235, 80 pp., 18 figs., 1932. [Received April, 1933.]

The following items are taken from the section of this report (by H. L. Blood and F. B. Wann) on botany and plant pathology (pp. 49–54). Bacterial canker of tomatoes [*Aplanobacter michiganense*] [*R.A.M.*, xii, p. 267] was so serious on early crops in the Bountiful district that production was largely discontinued; on canning tomatoes infection was generally less severe. The causal organism is capable of surviving the winter on plant refuse and reinfecting the new crops.

Curly top [ibid., xii, p. 196] was also responsible for heavy damage to tomatoes, affecting 56·7 and 42 per cent. of the crops in 1930 and 1931, respectively. The symptoms of this disease include a retardation of terminal growth accompanied by compression of the young leaves at the stem apex, reflexed, yellow leaf blades, stunting, and intensified vein coloration. Biochemical investigations showed an accumulation of carbohydrates and ash constituents in the foliage, combined with a rise in osmotic pressure. The abundance of alkaloids in diseased leaves suggests a possible interference with protein synthesis. Catalase activity was found to be much lower in curly top than in normal plants. Viroflay spinach has been very useful in overwintering the leafhoppers [*Eutettix tenella*] required for curly top resistance studies. Tomatoes are further liable to psyllid yellows, which is epidemic on potatoes [ibid., xii, p. 187 and below, p. 461]. So far intensive work on this problem has been precluded by the difficulty of carrying the insect vector (*Paratrioza cockerelli*) through the winter. The symptoms of the disease on the tomato are similar to those on potatoes and include enlarged nodes and cupping and yellowing of the foliage. In severe cases the growth habit of the plants is markedly altered. The feeding of only a few insects on potato plants may result in the development of yellows symptoms that persist until the removal of the insects. Light intensity has also been shown to influence the expression of psyllid yellows, indicating that the disturbance may be of physiological origin rather than due to a virus.

Apparently healthy soil was heavily infested with bunt [*Tilletia foetens*] spores on 28th August, 1930, and wheat sown at approximately 10-day intervals from 1st September to 1st November.

Observations made on 1st July, 1931 indicated (1) that the spores remained viable in the soil for a considerable time in the autumn; (2) that seedling infection may occur throughout the period of the sowings; and (3) that the incidence of bunt declines proportionally to the length of time from spore dissemination.

LEEFMANS (S.). **Ziekten en plagen der cultuurgewassen in Nederlandsch Oost-Indië in 1930.** [Diseases and pests of cultivated crops in the Dutch East Indies in 1930.]—*Meded. Inst. voor Plantenziekten*, 81, 84 pp., 1933.

This report, prepared on the usual lines [*R.A.M.*, x, p. 298], contains numerous interesting items, of which the following may be mentioned. In two districts of the Kedoe Residency (Java) the incidence of slime disease [*Bacterium solanacearum*] among the potato crops amounted to 15 and 30 per cent., respectively [ibid., x, p. 402].

Some 10 per cent. of the cabbage crops in one coastal district of west Sumatra were attacked by *Bact. campestre* [*Pseudomonas campestris*: ibid., x, p. 299].

Owing to the prevalence of bark and root diseases, 20 to 30 per cent. of the *Hevea* rubber trees in the older native plantations of the Tapanoeli Residency (Java) have become unproductive. *Helicobasidium compactum* [ibid., x, pp. 524, 557] was isolated from both young and older rubber material examined at the (Java) Central Rubber Experiment Station. *Helminthosporium* [*heveae*: ibid., vii, p. 308; xi, pp. 2, 433] is gaining ground in the Besoeki district of Java.

Sugar-cane was locally affected in parts of Java by the 'kalimati' disease, attributed by Miss Wilbrink to potash deficiency [ibid., x, p. 691].

Both in Java and Sumatra the principal damage to tea roots was caused by *Rosellinia arcuata* and *R. bunodes* [ibid., vii, p. 65; ix, pp. 162, 614]. Of the 70 cases of attack by these fungi examined in Java, 47 were on tea alone, 8 on *Leucaena glauca*, 6 on *Indigofera arrecta*, 4 on *Tephrosia candida* (the three last-named all *R. bunodes*), 3 on *Crotalaria* (both species on *C. usaramoensis*, *R. bunodes* on *C. anagyroides*) [ibid., x, p. 525], and one each (species not determined) on *Acacia decurrens* and *Albizzia falcata*.

In Central Java the most prevalent fungus on cacao roots is *F. lamaoensis* [*F. noxius*].

In the Atjeh Residency (Java) nutmeg was severely damaged by *Coryneum myristicae* [ibid., xi, p. 673], which rendered up to 50 per cent. of the crop unmarketable. The same fungus caused heavy losses of nutmeg in the districts under the supervision of the Tea Experiment Station, where *F. noxius*, *Phytophthora* sp., *Diplodia* sp., and cobweb fungi [thread blights of the Marasmioid group: ibid., vii, p. 675] were also reported.

Pepper [*Piper nigrum*] in the Atjeh and Palembang Residencies suffered extensively from an obscure die-back of the branches [cf. ibid., ii, p. 87]. In the former district the same plant is affected by a disturbance in which the fruit-bearing shoots are replaced, without apparent cause, by those producing nothing but leaves.

*Melia azedarach* trees in the east Brantas silvicultural area of Java were affected by a gummosis attributed to *Phoma* sp.

ORTON (C. R.) & STANLEY (A. R.). **Serum agglutination studies with soft-rot bacteria.**—Abs. in *Phytopath.*, xxiii, 1, p. 27, 1933.

Studies with fifty isolations of bacteria of the soft rot group (including *Bacillus aroideae, B. carotovorus*, and *B. phytophthorus*) showed that the organisms of the soft rotting group are not to be distinguished specifically by agglutination tests [*R.A.M.*, xi, p. 700]. For instance, two cultures of *Bacterium dissolvens* isolated from stalk rot of two sweet maize varieties [ibid., xi, p. 446] are identical in ordinary physiological tests but show no sign of cross-agglutination. With an antiserum from one of these cultures, however, cross-agglutination is obtained with *B. coli communis* and a strain of *B. aroideae* isolated from pe-tsai [*Brassica pekinensis*] in Japan. In the same way *B. aroideae* antiserum agglutinated two cultures of *Bact. tabacum* from Pennsylvania as much as, or more than, a culture of *B. aroideae* from Japan. It is concluded that the soft rot bacteria and such leaf-spotting organisms as *Bact. tabacum* are merely variants of *B. coli* and not distinct species.

GREANEY (F. J.). **Method of estimating loss in yield from cereal diseases.**—*Phytopath.*, xxiii, 1, p. 12, 1933.

For the past eight years in succession field experiments have been conducted in Manitoba to determine the value of sulphur dusting at different rates and intervals for the control of *Puccinia graminis*, and other cereal rusts [*R.A.M.*, xi, p. 286]. In order to use the data thus acquired in estimating losses, rust percentage and yield have been correlated in a single standard variety, the results being summarized annually in the form of correlation coefficients and regression equations. The regression of yield on percentage rust was found, in statistically significant correlation coefficients, to be linear, indicating that uniform increases in rust are accompanied by uniform reductions in yield. In this way it was possible to ascertain the reduction in yield for each 10 per cent. of black rust and so to calculate the annual losses from this source.

SĂVULESCU (T.). **Rumania: black rust of cereals in 1932 and the measures taken to prevent future outbreaks.**—*Internat. Bull. of Plant Protect.*, vii, 2, pp. 29–31, 1933.

Black rust of wheat (*Puccinia graminis*) caused excessively heavy damage in Rumania in 1932, when losses amounting to at least 50 per cent. were sustained from this source in the Danube Valley [*R.A.M.*, xii, p. 150]. The high yielding, long- and yellow-strawed, broad-leaved, late maturing, widely spaced spring wheats were the most severely attacked.

The following varieties are officially recommended, on the basis of their resistance to forms 13 and 20 of brown rust (*P. triticina*) as suitable for cultivation in the Danube Valley [cf. ibid., xi, p. 156]: American 15 and 26, Sandu-Aldea 22, 70, and 120, Ţigăneşti 714, and Sămânţa 117, while Sandu-Aldea 224, Odvoş 3,

and Filipescu are susceptible. In Banat and southern Transylvania, Sămânţa 117, Bankut 1·201, and Odvoş 241 should be grown, the two last-named being also adapted to northern Transylvania. In northern Moldavia and the steppes, the wheat selection No. 11 is superior to all others, while the best for Dobrudja are Urias cu pana roşie [with pink panicles] and Sămânţa 117. A reduction in the incidence of *P. graminis* can only be effected by the cultivation of early varieties and by the extermination of the barberry, an official campaign against which has been initiated.

STAKMAN (E. C.), HINES (L.), UKKELBERG (H. G.), & BUTLER (W.). **Distribution of physiologic forms of Puccinia graminis tritici in relation to stem-rust epidemiology in 1932.**—Abs. in *Phytopath.*, xxiii, 1, p. 34, 1933.

Contrary to the general rule, durum wheats suffered more severely from stem [black] rust (*Puccinia graminis tritici*) in 1932 than the bread varieties in the upper Mississippi Valley. This is explained by the distribution of the physiologic forms of the fungus in that year in the United States and northern Mexico [*R.A.M.*, xi, p. 436]. Fifteen forms were isolated from 465 collections, of which 92 per cent. were constituted by five forms as follows: form 38, 46 per cent.; 49, 27 per cent.; 36, 9 per cent.; 19, 5 per cent.; and 11, 5 per cent. Forms 38 and 19 are virulent on the durum varieties but cause little damage to the hard red spring wheats; the reverse is true of forms 49 and 36, while 11 attacks both groups severely. The following are the percentages of collections in representative areas from which durum-infecting forms were isolated: Mexico 54, Texas 67, Minnesota 61, and North Dakota 56. Of the Mexican and Texas collections, 54 and 63 per cent., respectively, were forms harmless to most hard red spring wheats. Field observations and spore trapping data support the evidence of the physiologic form survey that the rust was blown northward from Mexico and Texas, though certain forms, especially 36, apparently originated principally on northern barberries.

JOHNSON (C. O.) & MILLER (E. C.). **Effect of leaf-rust infection on water economy and growth of two Wheat varieties.**—Abs. in *Phytopath.*, xxiii, 1, pp. 19–20, 1933.

Two spring wheat varieties, Pusa No. 4 and Warden (C.I. 4994), the former susceptible and the latter resistant to leaf [brown] rust [*Puccinia triticina*: *R.A.M.*, xii, p. 274], were grown in sealed containers in the greenhouse and the water requirement determined for plants of various groups, arranged according to the time of initial rust infection. The following amounts (in grams) were required for each group of the two varieties: inoculated first in the seedling stage, 905·3 and 500·8; in the jointing stage, 869·9 and 490·0; in the boot stage, 791·4 and 509·3; when fully headed, 619·1 and 480·7; uninoculated controls, 456·8 and 510·8. In the susceptible Pusa No. 4, the water requirement increased with the continued association of host and parasite, involving a general check to growth and retardation of root development and date of maturity, none of which features was so pronounced in the resistant Warden.

KILDUFF (T.). **Inheritance of bunt and loose smut reaction and of certain other characters in Kota × Red Bobs and Garnet crosses.**—*Canadian Journ. of Res.*, viii, 2, pp. 147–172, 1933.

An account is given of the writer's genetic studies in Alberta on the $F_2$, $F_3$, and part of the $F_4$ progeny of two hard red spring wheat crosses, Kota × Red Bobs and Kota × Garnet, in respect of their reaction to bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] and loose smut (*Ustilago tritici*), certain other characters also being taken into consideration [cf. *R.A.M.*, xi, p. 360, *et passim*].

Kota and Red Bobs were highly susceptible both to Kota bunt (*T. foetens*) and to that from Red Bobs (mainly *T. caries*); the former collection was much more virulent than the latter. The heritable nature of the bunt reaction was clearly demonstrated. The percentage of infection found in the $F_3$ hybrids covered the whole infection range of the parents; no transgressive segregation was observed. In the Kota × Garnet hybrids evidence was obtained of the presence in Garnet of a single major factor for resistance to Kota bunt. Some of the $F_3$ plants showed resistance equal to that of the Garnet parent, a larger number showed the high susceptibility of Kota, but the majority fell in the classes showing 20 to 50 per cent. bunted.

Relative susceptibility to loose smut was shown by Kota, while Garnet was resistant and Red Bobs immune under the experimental conditions. No genetic hypothesis can be advanced to explain the data in regard to loose smut reaction owing to the absence of agreement in infection percentages in the $F_3$ and $F_4$ generations. It is suggested that some factor of a non-physiological order may be concerned in the relative resistance to *U. tritici* of the parental varieties.

BRESSMAN (E. N.) & HARRIS (L. E.). **Inheritance in Albit Wheat of resistance to bunt, Tilletia tritici.**—*Journ. Agric. Res.*, xlvi, 4, pp. 361–365, 1 pl., 1 chart, 1933.

In the autumn of 1930, the seed for the $F_3$ generation of crosses at Corvallis, Oregon, between Hybrid 128 and Albit wheat [cf. *R.A.M.*, xi, p. 565] was heavily coated with spores of *Tilletia tritici* [*T. caries*] physiologic form VIII, to which Hybrid 128 is susceptible and Albit resistant. Albit is the result of a cross between Hybrid 128 and White Odessa and possesses the bunt-resistance of the latter.

In the Hybrid 128 × Albit crosses the $F_1$, $F_2$, and $F_3$ progenies were all morphologically identical with the parent varieties and it was only through the segregation for bunt resistance that it could be determined that hybridization had been effected. The $F_3$ generation was represented by four families and a total of nearly 5,000 plants. The distribution of the $F_3$ rows into 10 per cent. classes for bunt infection agreed fairly closely with a 1 : 2 : 1 ratio when the 0–10 class was taken as resistant and those over 70 per cent. as susceptible; family no. 3 showed a perfect segregation of 1 : 2 : 1 with 4 resistant, 8 segregating, and 4 susceptible rows in a total of 16.

It is considered that Albit carries one main dominant factor for resistance which is the same (MM) as that present in its White Odessa parent [ibid., x, p. 649]. The results hitherto obtained show that this factor conveys resistance to physiologic forms II, III, V, VI, and VIII but not to the other forms I, IV, VII, IX, and X of Bressman's classification [ibid., xi, p. 33]. Hybrid 128 is entirely susceptible and carries no factor for resistance to any of the physiologic forms of *T. caries*.

YOUNG (P. A.). **Soil infestation by chlamydospores of Tilletia levis in Montana.**—Abs. in *Phytopath.*, xxiii, 1, p. 39, 1933.

Seed wheat, surface-sterilized with formaldehyde, was sown on four dates in September and three in October, 1931, in proximity to a wheat field, combine-harvested the previous August, in which 12 to 50 per cent. of the heads were infected by *Tilletia levis* [*T. foetens*], probably physiologic form 3 [*R.A.M.*, xi, p. 440; xii, p. 156]. The seed sown before 6th October emerged within 15 to 30 days and bore the following average percentages of bunted heads due to soil infestation by the smut: Turkey 11·9, Oro 0·8, Regal 0·9, Kharkof 2·7, Sherman 0·6, Ridit 0·2, Hybrid 128 12·5, Albit 0·2, Hussar 0·2, Kanred 12·1, Montana 36 20, and Jones Fife 21·9. Smutted Montana 36 in the control plot averaged 65 per cent. infection. The incidence of soil infestation decreased to zero in the later October sowings.

GAUDINEAU (Mlle M.). **Sur quelques facteurs de l'infection du Blé par la carie, Tilletia tritici (Bjerk.), Wint.** [On some factors affecting Wheat infection by bunt, *Tilletia tritici* (Bjerk.) Wint.]—*Ann. des Epiphyties*, xviii, 5, pp. 340–355, 3 graphs, 1932. [Received May, 1933.]

When seed of Bon Fermier (susceptible) and Florence 135 (resistant) wheat inoculated with bunt (*Tilletia tritici*) [*T. caries*] from the former variety at Versailles was sown at weekly intervals from 2nd September, 1931, until the end of March 1932, spring sowings gave the highest percentage of infections. Optimum conditions for infection prevailed at the sowings on 21st October and 24th February, these dates being very close to those on which similar conditions had prevailed in previous years. From 1st September until 15th October, 1931, the weather was consistently warmer than it was from 10th February to 25th March, so that conditions were more favourable for infection, and the attack was more severe, in the latter period than in the former [*R.A.M.*, x, p. 649]. The amount of infection that developed varied with the quantity of inoculum used [ibid., xi, p. 500].

As in earlier tests [ibid., xi, p. 442], Red Hussar, Martin Amber, and Ridit were highly resistant. Of the species of *Triticum* tested *T. monococcum* and *T. durum* were the most resistant. Inoculations gave negative results with *Aegilops triuncialis* [*T. triunciale*], but positive with *A. ventricosa* [*T. ventricosum*]. When tested on Red Hussar, inoculum from Cosel, Germany, gave 23·31 per cent. bunted plants and 14·03 per cent. bunted ears, as compared with 15·15 and 9·06 per cent., respectively, for that from Breslau, 5·78 and 3·69 per cent., respectively, for that from Halle,

and 2·16 and 1·07 per cent., respectively, for that from Zurich. No infection on Red Hussar resulted with inoculum from Lyngby (Denmark), Versailles, the Aisne, Dijon, or Colmar [ibid., x, p. 302].

A comprehensive bibliography is appended.

WINKELMANN (A.). **Weitere erprobte Beizgeräte.** [More tested disinfection apparatus.]—*Deutsche Landw. Presse*, lx, 8, pp. 93–94, 3 figs., 1933.

Technical details are given of the construction and application of three more seed disinfection apparatus officially tested and approved during 1931–2 [cf. *R.A.M.*, x, p. 373]. The Praktikus dusting machine (R. Brodmerkel, Sedanstr. 10, Augsburg) is constructed to dust 50 kg. of wheat or barley seed-grain with tillantin. If the short disinfection process is used (for which a special contrivance is supplied), the capacity is only 25 kg., the process requiring 8 to 10 minutes with 25 to 30 revolutions per minute.

The continuously working Separat apparatus (Gebr. Röber, Wutha, Thüringen) is constructed on the same lines as the Gross-Tillator 12 and 30 (Neuhaus) [loc. cit.]. The average quantity of tillantin adhering to 350 kg. of wheat seed-grain after an hour's treatment was 82·5 per cent. (71·5 per cent. after subsequent passage through the drill), the corresponding figures for 650 kg. being 76·75 and 64·75 per cent., respectively. In a similar test with rye 78·5 to 88 per cent. tutan was found adhering to the seed-grain (400 to 650 kg.) after an hour's treatment.

The Miag (formerly known as Germator, Mühlenbau- und Industrie A.-G., Brunswick) is the first continuously working short disinfection process apparatus to be tested in Germany [ibid., xi, pp. 117, 502]. Satisfactory results are stated to have been obtained with the three machines here described.

SPRAGUE (R.). **Association of Cercosporella foot rot with a specific ecological area.**—Abs. in *Phytopath.*, xxiii, 1, pp. 33–34, 1933.

In general, the foot rot of wheat caused by *Cercosporella herpotrichoides* [*R.A.M.*, xi, p. 503] is confined to those prairie sections of Oregon, Washington, and Idaho in which the fine sandy loam soils were formerly covered by a grass sod with *Festuca* spp. predominating. A list of the prominent plants in the affected sections is given.

NOBLE (R. J.). **Basal glume rot.**—*Agric. Gaz. New South Wales*, xliv, 2, pp. 107–109, 2 figs., 1933.

A brief, popular account is given of the symptoms and geographical distribution of basal glume rot of wheat (*Bacterium atrofaciens*) [*R.A.M.*, xi, pp. 227, 544], which, first recorded in New South Wales in 1924, has since been observed in widely scattered sections of the wheat belt there, and was again present in 1932. It does not appear to have caused any serious loss of yield so far, and the ordinary agricultural practices, such as burning the stubble, fallowing, and seed treatment, are expected to keep it under control.

ELLIOTT (CHARLOTTE) & JOHNSON (A. G.). **Basal glume rot of Barley.**—Abs. in *Phytopath.*, xxiii, 1, p. 10, 1933.

Barley heads received from Arkansas in 1931 showed the dull brownish-black kernel bases commonly associated with basal glume rot of wheat (*Bacterium atrofaciens*) [see preceding abstract], some typical specimens of which were sent at the same time. The organism in question was isolated from both wheat and barley, and cross-inoculation experiments gave positive results.

HOLTON (C. S.). **Inheritance of chlamydospore characteristics in Oat-smut fungi.**—Abs. in *Phytopath.*, xxiii, 1, p. 16, 1933.

The $F_1$ chlamydospores of crosses between monosporidial lines of the oat smuts, *Ustilago avenae* and *U. levis* [*U. kolleri*] are echinulate. In the $F_2$ generation both echinulate and smooth spores were segregated, the former invariably predominating. In hybrids between the buff smut fungus with smooth, hyaline spores resulting from a cross between two $F_1$ monosporidial lines [*R.A.M.*, xi, p. 37] and *U. kolleri*, colour segregated in a 3:1 ratio. The $F_1$ chlamydospores of crosses between the buff smut and *U. kolleri* were smooth and brown, and in those between the former and *U. avenae* echinulate and brown.

ZADE (A.) & ARLAND (A.). **The relation of host and pathogen in Ustilago avenae: a reply.**—*Bull. Torrey Bot. Club*, lx, 2, pp. 77–87, 1933.

In this paper the authors discuss in some detail the various criticisms directed by Dr. Laura Kolk [*R.A.M.*, x, p. 722] against the methods elaborated by them for the artificial inoculation of oat grains with *Ustilago avenae* [ibid., ii, p. 214; iv, p. 158; v, p. 27], and proceed to show that their method as now practised is simple and follows more natural lines than Kolk's dry spore-dusting method after dehulling the oat grains. Their method (termed 'evacuation process') consists in the removal by suction of the air present between the glume and the kernel, allowing of the subsequent intake by the grain of a suspension of the smut spores which then rapidly develop a resting mycelium when the grain is spread on moist blotting paper kept in a moist atmosphere. While the dry spore-dusting method may be useful in the study of inheritance of smut resistance, the authors claim supremacy for their own method for purposes of testing the efficacy of grain disinfectants for the control of the smut.

EDDINS (A. H.). **Infection of Corn plants by Physoderma zeae-maydis Shaw.**—*Journ. Agric. Res.*, xlvi, 3, pp. 241–253, 4 figs., 1933.

This is a full report of the results obtained up to date in the Florida experiments on the artificial infection of maize plants with the brown spot fungus, *Physoderma zeae-maydis*, brief references to which have already been noticed [*R.A.M.*, x, p. 646; xi, p. 771]. In addition to the information already given, it is stated that all the subspecies tested (including 38 southern varieties of dent and flint maize) were found to be susceptible. The work also indicated that it may be possible to develop resistant strains of certain

varieties by inbreeding, but it is stated that the behaviour of such lines in the greenhouse is not a true indication of their reaction in the field. In the test plots more brown spot developed in the wet season of 1930 than in the dry season of 1931, and the relative susceptibility of the different varieties varied in the two years.

As regards the longevity of the sporangia of *P. zeae-maydis*, it was found that infection was produced by sporangia that had been kept for three years in test tubes buried a foot deep in the ground, in a bottle for the same length of time in the laboratory, in maize leaf sheaths exposed to the weather for two years, as well as by sporangia collected from diseased areas in green leaf sheaths.

DICKSON (J. G.), LINK (K. P.), & DICKSON (A. D.). **Nature of resistance of Corn to seedling blight.**—Abs. in *Phytopath.*, xxiii, 1, p. 9, 1933.

Previous investigations in Wisconsin denoted that resistance in maize seedlings to the blight caused by *Gibberella saubinetii* is correlated with rapid maturation of the tissues, especially of the cortical structures [*R.A.M.*, xi, p. 447]. The embryonic tissues in resistant seedlings have shown a much higher degree of acidity, associated with the presence of polyglucuronides, than similar regions in susceptible plants; at 12° to 16° C. the resistant seedlings contained some 20 per cent. more uronic acids than the susceptible ones. Dilute solutions of the uncombined acids gave a $P_H$ of 2·5 to 3·0 and reduced fungus growth when added in low concentrations to the culture solutions. The calcium salts of the acids were much less active in inhibiting the development of *G. saubinetii*.

RODENHISER (H. A.) & BARNES (B. F.). **Pathogenicity of certain hybrids of covered and loose smuts of Sorghum.**—Abs. in *Phytopath.*, xxiii, 1, pp. 30–31, 1933.

Intraspecific crosses were made by pairing monosporidial lines of physiologic forms 1 and 2 and of 1 and 3 of *Sphacelotheca sorghi*, while interspecific hybrids were obtained by pairing a monosporidial line of form 2 and one of form 3, respectively, with a monosporidial line of *S. cruenta* [*R.A.M.*, xii, p. 89]. On the susceptible Reed kafir variety the intraspecific crosses were more virulent than the inbred lines of either parental form, while the latter in their turn were more virulent than the interspecific hybrids. In general, on the sorghum varieties susceptible to one inbred parent and resistant to the other, both intra- and interspecific $F_1$ chlamydospores proved to be intermediate in their virulence. On kafir × feterita (H.C. 2423), the interspecific hybrid arising from a cross of form 3 of *S. sorghi* with *S. cruenta* was only slightly less virulent than either parent. Spur feterita (C.I. 623) was immune in all the pathogenicity tests.

UPPAL (B. N.) & DESAI (M. K.). **Physiologic specialisation in Sclerospora graminicola (Sacc.) Schroet.**—*Indian Journ. Agric. Sci.*, ii, 4, pp. 667–678, 1 pl., 1932. [Received April, 1933.]

This is the full report of the authors' study of physiological

specialization in *Sclerospora graminicola*, an abstract from which has already been noticed [*R.A.M.*, x, p. 517; cf. also xi, p. 634].

PARK (M.). **Citrus canker.**—*Trop. Agriculturist*, lxxx, 2, pp. 124–125, 1933.

A brief account is given in popular terms of the symptoms of citrus canker (*Pseudomonas citri*) [*R.A.M.*, x, pp. 80, 786], which in Ceylon attacks all varieties growing at altitudes under 3,000 ft.; localities where the rainfall is evenly distributed throughout the year suffer most. Mandarin [*Citrus nobilis* var. *deliciosa*] is probably the most resistant variety, grapefruit being susceptible. The control measures recommended consist in removing and burning all infected material, cutting back to the healthy wood, and spraying weekly in wet, and fortnightly in dry, weather. If possible, the trees should be protected by windbreaks.

**State Plant Board of Florida. Report for the period July 1, 1930–June 30, 1932 (Ninth Biennial Report).**—42 pp., 1933.

Up to 30th June, 1932, the total number of properties in Florida that had been found infected by citrus canker [*Pseudomonas citri*: *R.A.M.*, vii, p. 287; x, p. 643] was 515, none of which, however, is now in an active state of infection or requires placing under full or partial quarantine. The total number of grove trees found infected between 1st May, 1914 and 30th June, 1932 was 15,243 and the total number of 'exposed' grove trees destroyed during the same period, 242,502. The number of infected nursery trees amounted to 342,260 and the number destroyed to 2,740,850. No new infections have been found since November, 1927.

BRITON-JONES (H. R.). **The control of scab disease (Sporotrichum citri Butler) in the British West Indies.**—*Trop. Agriculture*, x, 2, pp. 40–42, 1933.

The results of experiments [details of which are given] made in 1932 in Trinidad showed that in sour orange [*Citrus aurantium* var. *bigaradia*] seedlings badly affected with scab (*Sporotrichum citri*) [*R.A.M.*, xii, p. 166], which were planted at the beginning of August, some under shade and some exposed to the sun, the incidence of the disease in the middle of October was 67·5 per cent. in the plots exposed to full sunlight and 33·6 per cent. in plots that were artificially shaded, and was 73 and 16 per cent., respectively, at the end of November. The disease injures the apical buds and frequently necessitates the training of a more vigorous lateral shoot into a new leader in order to produce a single stemmed plant suitable for budding, the other shoots being trimmed off. The percentage figures for the disease were determined from the number of plants requiring this trimming. In the author's experiments the shaded plots were covered with coco-nut leaves supported by wooden uprights and bamboo cross-pieces at a height of 4·5 feet above the ground, but in another test very good results were obtained by growing the seedlings in the shade afforded by Guatemala grass (*Tripsacum laxum*), and several local planters are successfully using various other plants as shade in the control

of scab in their sour orange nurseries. It is recommended to use such shade plants as can be ratooned, since the shade should be thinned out about a month before budding is done, after which it should be reduced to a minimum so as to allow the growth of young trees which will not suffer a serious set-back when transplanted into their permanent position in the citrus groves.

The experiments also indicated that shade is equally effective in the control of leaf spot (*Colletotrichum zingiberis*) [ibid., xi, p. 545] of ginger.

JOHNSTON (J. C.). **Zinc sulfate promising new treatment for mottle leaf.**—*California Citrograph*, xviii, 4, pp. 107, 116–118, 5 figs., 1933.

Owing to the success of the application of zinc in the control of the little leaf disease of deciduous fruit trees [*R.A.M.*, xii, p. 205] and the fact that certain types of mottle leaf of citrus [ibid., xi, p. 570] are associated with little leaf symptoms in California, 18 navel orange trees showing on an average 78 per cent. mottle leaf were treated in November, 1931, by spreading 5 to 30 lb. zinc sulphate round the trunks in circles 1 to 8 ft. in radius, 18 adjacent trees showing an average of 63 per cent. mottle leaf being kept untreated. By November, 1932, the treated trees averaged 13·6 per cent. mottled leaves and the untreated 42 per cent. The general effect of the treatment was to restore the foliage to normal where sufficient material was applied.

Similar applications (2·5 to 20 lb., radius 1 to 4 ft.) made to badly affected lemon trees (also suffering from die-back) greatly increased leaf area and, on an average, increased the size of the trees by 50 per cent., most of the trees putting out new growth for the first time. An application of 20 lb. zinc sulphate severely injured one tree.

On a third plot, consisting of Valencia oranges which for 12 years had shown a slow decline, mixed with plums showing 100 per cent. little leaf, applications of 40 and 20 lb. zinc sulphate per tree gave highly satisfactory results, 15 lb. gave some response, and even 2 lb. when applied in a 6-in. radius gave perceptible, if slight, improvement.

Treatment by inserting zinc sulphate crystals into the trunk or by spraying with various mixtures containing zinc proved less satisfactory.

SACCHETTI (M.) & EMILIANI (E.). **La fermentazione citrica del saccarosio coll'Aspergillus niger v. Tiegh. (Nota preliminare).** [The citric fermentation of saccharose by *Aspergillus niger* v. Tiegh. (Preliminary note).]—*Indus. Sacc. Ital.*, xxvi, 2, pp. 45–49, 1933.

From rotten lemons the writers isolated a strain of *Aspergillus niger* which is capable of transforming sucrose into citric acid with a yield of 40 per cent. This particular strain is much more active than the strains of *Citromyces* and *Aspergillus* hitherto known as citric-acid producers [*R.A.M.*, iv, p. 52; xi, p. 119]. The activity of the fungus is promoted by phosphates and magnesium salts, but an excess of nitrogen is detrimental.

STAHEL (G.). **Verslag van den Directeur.** [Report of the Director.]—*ex* **Verslag over de jaren 1931 en 1932.** [Report for the years 1931 and 1932.]—*Dept. Landbouwproefstat. Suriname,* pp. 5–34, 1933.

The following items of phytopathological interest occur in this report. The outcome of H. G. Bünzli's experiments in 1931, and those of the writer in 1932, in the transmission of the sieve-tube disease (phloem necrosis) of coffee by the coccid, *Rhizoecus coffeae,* failed to justify the supposition that the flagellates [*Leptomonas vasorum*] are conveyed by its agency from infected to healthy trees [*R.A.M.*, xi, p. 637]. It was further found, by the examination of cross sections of the proboscis of *R. coffeae* and another root coccid, *Ortheziopoda reynei,* that the bore of the tube of the stylet measures only 0·20 to 0·25 $\mu$ in width and would, therefore, not accommodate even the smallest specimens of *L. vasorum.* Contrary to expectation, it thus appears highly improbable that these coccids play any part in the dissemination of the sieve-tube disease. Similar tests are in progress with two species of bugs with stylet tubes 4 $\mu$ in width; the occurrence of these insects on the roots and collar is, however, much less constant than that of the coccids.

At the time of the first epidemic of witches' broom [*Marasmius perniciosus*] of cacao in Surinam about 1900 [ibid., xi, p. 703], it was thought in certain quarters that the infection had spread from the similarly affected wild *Eugenia latifolia* trees growing along the trenches in the plantations. However, it has now been ascertained that the witches' brooms of the wild plant are caused by a bacterium, *Pseudomonas hypertrophicans,* and have no connexion with the cacao disease.

In the Coronie district 747 coco-nut palms were eradicated in 1931 and 592 in 1932 in the official campaign against bud rot [*Phytophthora palmivora*], bringing the total number thus destroyed since 1918 to 24,707 [ibid., iv, p. 723].

COLEMAN (L. C.). **Report of work on the Coffee Experiment Station, Balehonnur, for the years 1930 and 1931.**—*Mysore Coffee Exper. Stat. Bull.* 8, 31 pp., 3 figs., 2 plans, 1932.

In this report on the work of the Balehonnur Coffee Experiment Station, Mysore, India, it is stated that the chief coffee diseases in southern India are leaf disease [*Hemileia vastatrix*: *R.A.M.*, xi, pp. 368, 636; xii, p. 286], black rot [*Corticium koleroga*: ibid., x, p. 239], die-back [ibid., xi, p. 368], and root rot [*Fomes noxius* and *Rosellinia* sp.: ibid., xi, p. 367].

Spraying tests [by W. W. Mayne] indicated that the most satisfactory combination of spreader and fungicide against coffee diseases is casein-Bordeaux, linseed oil-Bordeaux presenting certain practical difficulties in the field and being (at 20 oz. per 50 galls.) more expensive and slightly less effective. In 1931–2 the yield per acre of 1,200 plants sprayed with casein-Bordeaux was 3,051 lb. as against 2,835 lb. and 2,658 lb. for linseed-Bordeaux 20 and 10 oz. per 50 galls., respectively. Resin-Bordeaux gave only 2,575 lb., and Burgundy mixture with fish oil-resin soap adhesive only 1,806 lb., as against 2,182 lb. for Bordeaux mixture even without an adhesive. Leaf counts demonstrated that both pre- and post-

monsoon applications are required and that there is little, if any, difference in effectiveness between full strength and half-strength mixtures, so that it is considered that 0·5 per cent. Bordeaux mixture will probably be effective.

Excluding the labour cost for transporting water from a stream or tank (estimated at from 12 annas to 1 rupee 4 annas per day) [1 rupee = 16 annas = 1*s.* 6*d.* at par], the expense of the labour necessary to work a Drake and Fletcher D.S.P. sprayer, using two pumps at one centre and applying 1,000 galls. to $2\frac{1}{2}$ acres per day, amounted to a little more than 2 rupees 3 annas per acre, as compared with Rs. 2–10 for a Holder Power Sprayer covering 3 acres with 1,200 galls. per day, and giving a better spray: the daily fuel consumption of the power machine cost Rs. $2–15\frac{1}{3}$. The labour cost per acre of 8 two-gallon hand sprayers together covering 1 acre per day was slightly over Rs. 4–3. Taken together, the costs of labour and spray mixture for the power machine, the D.S.P. sprayer, and the 8 hand sprayers amounted, respectively, to Rs. 16–8, 16–1, and 18–1 per acre when 1 per cent. Bordeaux with casein was used and to Rs. 10–4, $9–14\frac{1}{2}$, and $11–13\frac{1}{3}$ when 0·5 per cent. solution was used. The amount of mixture needed to cover an acre varies greatly with the kind of coffee bushes to be treated, but 400 galls. represents a fair average.

MAYNE (W. W.). **The function of spraying in Coffee crop production.**—*Planters' Chron.*, xxviii, 2, pp. 34–38; 3, pp. 53–56, 1933.

In this discussion of the respective advantages of spraying and improved cultivation in the control of coffee leaf disease [*Hemileia vastatrix*: see preceding abstract] in southern India, the author states that as the vigour of the fungus is largely determined by that of the host, cultivation and manuring cannot control the disease though they may assist the trees to bear infection if adverse climatic conditions do not prevail too long. Heavy shade, by reducing the assimilation of carbon compounds, checks the disease at the expense of the crop. Prolonged adverse climatic conditions prevail in certain districts in southern India, where one small area, for instance, showed in two consecutive years the loss by January of nearly all the leaf produced between April and October of the previous year. It was evident that the only factor limiting the disease was the number of available leaves. The disease must be fought by direct methods, but whether these are worth while economically in any given case must be determined by climatic considerations and the general suitability of the locality for coffee cultivation.

In attacks of black rot [*Corticium koleroga*] the governing climatic factors are more limited in time and distribution than they are with leaf disease. While their effects can to some extent be mitigated by such methods as burying mulch, 'centring' bushes, and reducing excessive shade, none of these gives such satisfactory control as spraying.

As both leaf disease and black rot cause most defoliation during the latter part of the south-west monsoon and the period following, when the bushes are accumulating reserves for blossom-bud differen-

tiation, these diseases exercise a direct effect on crop. Further, any available reserves are liable to be consumed in the production of fresh leaf, with consequent depletion of the plant and inability of the new leaf to make up the necessary surplus of carbon compounds. The increase in crop which results from spraying is directly due to the conservation of the plant's carbon-compound manufacturing apparatus, enabling it to function successfully through the moist, sunny months of the latter part of the year, storing up reserves utilized in developing fruit buds. Taken as a whole, the effects of manuring in southern India are of a much lower order than those obtained by spraying to increase the healthy functional leaf area. In some cases in coffee cultivation protection against disease is the fundamental cultural problem.

Manuring, except perhaps on very old estates, and in special cases, should be regarded as an insurance against deterioration and not, as at present, as a direct means of increasing crop on estates where control methods have recently been instituted. Manuring with reference to the minerals removed by the average crop is the best method of maintaining the mineral food level in the soil.

PICADO (C.). **Fusarium disease of Coffee in Costa Rica.**—*Journ. Dept. Agric. Puerto Rico,* xvi, 4, pp. 389–400, 4 pl., 1932.

Coffee plants attacked by the *Fusarium* disease recently reported from Costa Rica [*R.A.M.*, xi, p. 369] yield progressively less every year. The affected plants fail to renew growth on the onset of the spring rains and any new shoots formed die and turn charcoal-black, or if they remain green, cease growing and bear abnormal leaves and twigs. In abandoned fields the tops are dead and there is a growth of thin unproductive branches underneath. At present the crop in the affected area is reduced by about 25 per cent. Cultures of the causal organism may be nearly white, or orange, deep vermilion or violaceous red. After two days, especially in the red colonies, unicellular conidia measuring 6 by 3 $\mu$ were produced, the white colonies giving 2-, 3-, or 5-septate conidia with curved ends, measuring 40 by 4 $\mu$. Old mycelium ground up after being grown in Richards's solution emitted a characteristically acrid odour.

On the host the sporodochia, which generally arose behind the leaf scars, produced either micro- or macroconidia. The conidiophores usually had four segments and, if short and thick, usually bore ovoid microconidia averaging 7 by 3 $\mu$ in diameter. The macroconidia formed on the host were almost straight except for the curved ends and averaged 40 by 4 $\mu$. Some 6- or 7-septate spores measured 60 by 7 $\mu$. Intercalary, spherical, rarely elliptical chlamydospores were usually formed in sugar-agar plates and old carrot slants. The fungus is regarded as an undescribed species of *Fusarium* and is named *F. anisophilum*.

What is considered to be the perfect stage of *F. anisophilum*, a *Nectria* named *N. anisophila* n. sp., was found in lesions on diseased shade trees. It is characterized by deep orange (almost vermilion) perithecia arranged singly or in colonies and measuring 270 to 340 $\mu$ in diameter. The cylindrical asci measure 70 to 90 by 12 to 14 $\mu$ and contain eight hyaline, smooth, elliptical or

fusoid, 1-septate, uniseriate spores measuring 14 to 15 by 6 to 7 $\mu$; filiform, branching, twisted paraphyses also occur. The conidial stage of *N. anisophila* reproduced completely the cultural and pathogenic reactions of *F. anisophilum*. Ascospore cultures of *N. anisophila* reproduced the perfect stage when grown on coffee shoots in a damp chamber, provided the source was *Inga* trees, but subcultures from living coffee inoculated with *N. anisophila* failed to produce perithecia when grown on coffee shoots in a damp chamber. By passing through the coffee plant the fungus loses its ability to produce its perfect stage.

Direct inoculations of coffee leaves and branches were unsuccessful. Inoculations into thick roots of old trees also failed, though later on the fungus reached the finer roots through the soil and caused infection. Uninjured seedlings in the cotyledonary stage grown in inoculated soil in pots did not contract the disease, but other similar ones punctured at the collar were greatly retarded in growth. One-year-old plants similarly grown were immediately attacked, whether wounded or not, the fungus destroying the cortex from the base of the stem upwards. At 18° to 22° C. such plants remained apparently healthy for at least five months, but when taken outdoors (45° in the sun) they began to lose their leaves in about five weeks, by which time the cortex of the branches had begun to dry. A field test showed that the fungus spread rapidly through the soil and attacked two-year-old plants.

Lima beans [*Phaseolus lunatus*] near an inoculated plot were attacked, and a natural infection occurred on a *Poinciana regia* tree under which diseased wood was piled. On coffee shade trees lesions and symptoms resembling those on coffee were noted, and *F. anisophilum* was isolated from affected roots and branches. *N. anisophila* was found in the dead branches of *Gliricidia maculata*, *Inga* sp., and *Erythrina* sp.

The spread of infection is due to neglect of pruning and to piling up the waste wood (when the trees are pruned) in or near the coffee plantations. Once the soil becomes infected the fungus attacks the small rootlets, and in poor soils where root development is feeble even slight infections are disastrous. Recommendations are made for the pruning and burning of all diseased wood and avoidance of the use of susceptible shade trees in new plantings.

**Reports received from Experiment Stations, 1931–1932.**—173 pp., 1 pl., 44 graphs, 2 plans, London, Empire Cotton Growing Corporation, 1933.

This compilation of the reports for the season 1931–2 received from various cotton-growing stations in the British Empire [cf. *R.A.M.*, xi, p. 450] contains, among others, the following items of phytopathological interest.

The alternative hosts and insect vectors of internal boll disease in South Africa [associated with *Nematospora gossypii* and *N. coryli*: ibid., x, p. 519] were investigated, and it was ascertained that early in the season (December to January) ratoon cotton showed considerable staining before any species of *Dysdercus* appeared. Apparently, infection is carried by a number of Heteroptera, largely Pentatomidae, for the other hosts of which (known

to include several Leguminosae) search is being made. In North-Western Rhodesia the injury done by species of *Dysdercus* is stated to be the limiting factor in establishing cotton as a commercial crop. The Pentatomid *Callidea dregei* was present in considerable numbers, but as compared with the stainers was of minor importance as a carrier of internal boll rot [*Nematospora* spp.]

At Shambat (Sudan) little blackarm [*Bacterium malvacearum*: ibid., xii, p. 91] developed, the cotton finally attaining a greater height than in the previous year. Leaf curl was sporadic and slight, but two infections (believed to be the first records on this type) were observed on Asiatic cottons. At the research farm in the Gezira area nearly 90 per cent. leaf curl was present, but here also individual plants were less severely attacked than usual; the control rows of Sakel averaged 85 per cent. infected plants, as compared with only 8·5, 13·5, and 15·5 per cent. for Shambur IV, X.H. 1029, and X.H. 1229, respectively.

In experiments in Uganda it was found that seed treated with sulphuric acid gave the least primary infection with *Bact. malvacearum* [see above, p. 421]. There was no difference between the amount of primary infection that developed in plants from untreated seed and from seed dusted with a mercury compound, though the same dust gave a higher initial germination than any other treatment. The highest primary infection followed steeping the seed in a strong emulsion of *Bact. malvacearum.* By the time secondary infection appeared there was no longer any real difference between the effects of the various treatments.

At Domira Bay, Nyasaland, stainer was present in sufficient quantity to cause a bad outbreak of internal boll disease [*Nematospora* spp.], but the amount of stained cotton was negligible.

At Sigatoka, Fiji, *Bact. malvacearum* appeared in March, causing much boll rot in some fields [ibid., viii, p. 510]; Shambur IV and Sea Island varieties were those most affected, New Guinea Hybrid showing partial resistance.

MAHALANOBIS (P. C.) & BOSE (S. S.). **Statistical notes for agricultural workers. No. 5. A note on the variation of the percentage infection of wilt disease in Cotton.**—*Indian Journ. Agric. Sci.*, ii, 4, pp. 704–709, 1932. [Received April, 1933.]

The statistical study of the results obtained in 1931 by Kulkarni in experiments to determine the bearing of the date of sowing of cotton on the relative incidence of wilt [*Fusarium vasinfectum*: *R.A.M.*, viii, p. 309] in the ensuing crops showed distinctly significant differences in mean percentage infection of the plots sown in June (20·10) and in August (13·87), respectively; the difference between the June and July (15·57) plots was on the verge of significance, but that between the July and August plots was practically insignificant. The general trend was to show more wilt in the earlier plots.

NEAL (D. C.) & WESTER (R. E.). **An undescribed sclerotium fungus prevalent in northeast Texas.**—Abs. in *Phytopath.*, xxiii, 1, p. 24, 1933.

Decayed cotton stalks and roots a few inches below soil level at

Greenville, Texas, were found, following a wet period in September, 1932, to bear white to pale yellow, ovoid or ellipsoid, smooth sclerotia, measuring 5 by 1 mm. and formed of anastomosed hyaline hyphae; they developed on mycelial strands similar to those of *Phymatotrichum omnivorum* though finer in texture, and were variously constricted and often forked at the strand connexions. The mycelium is septate and branching, and certain new cells arising from the side of a parent hypha tend to grow in opposite directions. Pending further investigations, the name *Ozonium texanum* n. sp. is proposed for the fungus.

GRIMES (M.), CUMMINS (H. A.), & KENNELLY (VIOLET C. E.). **Étude des champignons trouvés dans le lait, la crème et le beurre.** [A study of the fungi found in milk, cream, and butter.]—*Le Lait*, xii, 119, pp. 894–903; 120, pp. 1071–1079, 1932; xiii, 123, pp. 291–307, 4 pl., 1933.

This is a French version of the authors' accounts of the fungi isolated by them from milk, cream, and butter in Ireland, the English text of which has already been noticed [*R.A.M.*, ix, p. 185; x, p. 241].

ALMEIDA (F. P. de). **Contribuição para o estudo da morphologia do Coccidioides immitis nos tecidos parasitados.** [A contribution to the study of the morphology of *Coccidioides immitis* in parasitized tissues.]—*Ann. Fac. Med. São Paulo*, vii, pp. 117–123, 3 pl., 1932. [English translation.]

Attention is drawn to the occurrence of some peculiar morphological structures in two cultures of *Coccidioides immitis* [*R.A.M.*, xii, p. 288 and next abstract] from the United States used by the writer for inoculation experiments on guinea-pigs, on which they proved to be uniformly fatal. In one of these an active formation of endospores was found 25 days after inoculation, and material containing the parasite was preserved sealed off from air. A year later some of the cells containing endospores showed fine, short filamentous processes radiating into the surrounding matrix. The processes were up to 5 to 10 $\mu$ in length and were sometimes present throughout the periphery of the cell and in other cases limited to certain areas. The cells bearing these processes were about 45 to 55 $\mu$ in diameter, excluding the capsule.

ALMEIDA (F. P. de). **Considerações em torno do Coccidioides immitis e do Pseudococcidioides mazzai.** [Some reflections on *Coccidioides immitis* and *Pseudococcidioides mazzai.*]—*Ann. Fac. Med. São Paulo*, viii, pp. 83–91, 10 pl., 1932. [English translation.]

The results of the author's comparative studies on *Coccidioides immitis* and *Pseudococcidioides mazzai* in Brazil, in which it is concluded that the latter is a synonym of the former, have already been summarized from another source [*R.A.M.*, xi, p. 782].

MOORE (M.). **Blastomycosis: report of a case, with a study of an etiologic factor and a classification of the organism.**—*Ann. Missouri Bot. Gard.*, xx, 1, pp. 79–118, 2 pl., 1933.

The history of blastomycosis is outlined and its etiology, clinical

manifestations, and differential diagnosis discussed in connexion with a case in a 43-year-old farmer recently treated by the writer. The organism isolated from lesions on the patient's left arm and hand was grown on a number of standard media [its characters on each of which are described], and found to correspond with Gilchrist's *Blastomyces dermatitidis* [*R.A.M.*, xii, p. 23]. Supplementary observations, however, revealed the inclusion of asci and ascospores in the life-history of the fungus, which is accordingly transferred to the Endomycetaceae [cf. next abstract] as *Endomyces dermatitidis* n. comb., with a revised diagnosis in English. The organism is characterized by budding, yeast-like cells 7 to 12 $\mu$ in diameter and up to 20 $\mu$ in length, occurring singly or in groups of two to four. On agar media septate, thin-walled hyphae form and bear laterally, usually near a septum, numerous piriform or round, pedunculate or sessile conidia measuring about 5 $\mu$ in diameter. Racquet hyphae also occur, the broad part ranging from 3 to 6 $\mu$ in diameter. The terminal, lateral, or intercalary chlamydospores measure 12 to 15 by 5·5 to 7·5 $\mu$, or 7 $\mu$ in diameter when round. The development of asci was observed in cultures, preceded by the fusion of two terminal cells from the ends of the main hyphae or of lateral branches. This resulted in the formation of a spherical, thick-walled ascus measuring 8 to 13 $\mu$ in diameter and containing eight spherical to ovoid, smooth, hyaline to pale chamois-coloured spores, 2 to 3 $\mu$ in diameter. The colonies are white at first, turning cinnamon to brown with age.

An eight-page bibliography is appended.

MacBryde (C. M.) & Thompson (E. I.). **Meningitis and dermatitis caused by a new variety of Blastomycete (Endomycete.)**—*Arch. of Dermatol.*, xxvii, 1, pp. 49–69, 4 figs., 1933.

Full clinical details are given of a fatal case of meningitis in a young man who had been suffering for the previous three years from a so-called blastomycetic dermatitis. This is believed to be the first record of the kind. The organism isolated from the spinal fluid, urine, and blood was identified as a new variety (*isabellina*) of *Endomyces capsulatus* [*R.A.M.*, ix, p. 34], its morphological and cultural characters being described at length. The hyphae vary considerably in diameter on different media; chlamydospores measuring 11 by 5 $\mu$ develop from a racquet mycelium; the piriform, sessile conidia measure 6 by 5 $\mu$, and the eight-spored asci 5·5 to 12 $\mu$ in diameter. The organism forms chamois- or pale isabella-coloured colonies on Sabouraud's agar. It was pathogenic to rabbits, guinea-pigs, and mice.

Niño (F. L.). **Glositis blastomicética.** [Blastomycetic glossitis.] —*Prensa Med. Argent.*, xx, 7, pp. 361–371, 20 figs., 1933.

Details are given of a fatal case of glossitis in a 58-year-old male patient, accompanied by intestinal disorders resembling those of sprue. The causal organism [the morphological and cultural characters of which are described] was identified as *Monilia pulmonalis* [*R.A.M.*, xii, p. 218] or a very close relative.

Ota (M.) & Huang (P.-T.). **Sur les champignons du genre Pityrosporum Sabouraud.** [Note on the fungi of the genus *Pityrosporum* Sabouraud.]—*Ann. de Parasitol. Humaine et Comp.*, xi, 1, pp. 49–69, 2 figs., 1933.

The authors describe their studies of three strains of *Pityrosporum*, namely, (*a*) supplied to them by Acton and Panja from Calcutta [*R.A.M.*, vii, p. 325], (*b*) obtained from Castellani who in 1925 had described it under the name *Cryptococcus graciloides* [ibid., iv, p. 607], and (*c*) isolated by Huang from two different sources. On the ground of their morphological and cultural characters [which are described] all the three strains are considered to be true *P. ovale*. Inoculations into man all gave negative results, indicating that the fungus can scarcely be considered as the cause of pityriasis capitis; in mice it produced some minor microscopic lesions in the internal organs, but did not appear to be able to persist in them, since a number of inoculated mice survived a long time in apparent good health.

*P. ovale* is an anascogenous blastomycete closely related to *Cryptococcus* (= *Torulopsis* Berlese) [cf. ibid., viii, p. 677], but differs from the latter in some morphological and biological respects. A cursory review of the relevant literature shows that probably it was for the first time described by Rivolta in 1870 under the name *C. psoriasis*, a misleading binomial. The term 'spore' applied to it by Malassez in 1874 was changed in 1891 by Unna to 'Flaschen-Bacillus'. In 1884 Bizzozero described two varieties of the fungus under the names *Saccharomyces sphaericus* and *S. ovalis*, which were reunited by Oudemans as *S. capillitii*. According to Brumpt the generic name *Pityrosporum* was created by Sabouraud, who named Malassez's 'spore' *P. malassezi*, but the authors prefer to follow Brumpt in selecting Bizzozero's name *P. ovale* [1882], owing to its wide usage among dermatologists and mycologists. Benedek's *S. malassezi* is believed to be a yeast quite distinct from *P. ovale*.

Sampaio (N.). **Contribution à l'étude des dermatomycoses portugaises. Les teignes de Lisbonne.** [Contribution to the study of Portuguese dermatomycoses. The ringworms of Lisbon.]—*Ann. de Parasitol. Humaine et Comp.*, xi, 1, pp. 46–48, 1 pl., 1933.

In this paper the author gives an annotated list of the fungi isolated by him from 33 cases of human ringworm in Lisbon, among which 21 were due to *Trichophyton violaceum* [*R.A.M.*, xii, p. 218]. It also includes some observations on the behaviour of the organisms in culture.

Grigorakis (L.). **Sur un nouveau milieu de conservation des dermatophytes (pléomorphisme, caractère acquis, spécificité tissulaire).** [On a new medium for the conservation of the dermatophytes (pleomorphism, acquired characters, histological specificity).]—*Comptes rendus Acad. des Sciences*, cxcvi, 1, pp. 60–62, 1933.

The writer has found the following medium eminently satisfactory for the cultivation of certain dermatophytes: calf spleen

pulp 50 gm., agar 1·8 gm., peptone 1 gm., and water 100 c.c. On this medium at 28° C., *Arthrosporia* [*Achorion*] *schoenleini* developed much more profusely than on sugar and peptone agar, while *Spiralia radiolata* [*Trichophyton radiolatum*] not only grew more rapidly than on Sabouraud's medium but showed no trace of pleomorphism [*R.A.M.*, xi, p. 373]. Similar results were obtained with other species. The high content of the spleen in lipoids affords the organisms in question a similar type of nutriment to that derived from their parasitic activities.

LIEBESNY (P.), WERTHEIM (H.), & WERTHEIM (H.). **Über Beeinflussung des Wachstums von Mikroorganismen durch Kurzwellenbestrahlung. I. Mitteilung.** [On the influence of short-wave radiation on the growth of micro-organisms. Note I.] —*Klin. Wochenschr.*, xii, 4, pp. 141–145, 1933.

Out of eight human pathogens (fungi) exposed *in vitro* for 20 minutes to short-wave irradiation (150 milliamperes), only two were retarded in growth, viz., *Trichophyton gypseum* and *Achorion schoenleini*, the effect being more noticeable in the former. The development of several other human pathogenic fungi was considerably stimulated by irradiation.

The results of the tests (which further included a number of bacterial agents of human disease) are discussed in the light of their application to short-wave therapy.

TAKASU (B.). **Über eine bisher noch nicht beschriebene Art von Trichophyton (Sabouraudites-Art von Ota und Langeron) und ihre Beziehungen zu Sabouraudites ruber (Bang), sowie Trichophyton coccineum.** [On a hitherto undescribed species of *Trichophyton* (*Sabouraudites*-species of Ota and Langeron) and its relationships with *Sabouraudites ruber* (Bang) and *Trichophyton coccineum*.]—*Japanese Journ. of Dermatol.*, xxxiii, 2, pp. 193–204, 18 figs., 1933. [Japanese, with German summary on pp. 37–39.]

In 1931, in Chugoku, Japan, the writer isolated, from the parietal region of a schoolboy affected by ringworm, a fungus culturally resembling *Trichophyton coccineum* [cf. *R.A.M.*, xi, p. 646] and morphologically closely related to *Sabouraudites ruber* [ibid., xii, p. 94].

The hyphae measured 4·5 to 5·5 $\mu$ in diameter and bore a few lateral spores, 4·5 $\mu$ in diameter; terminal or intercalary chlamydospores, racquet-shaped elements, and pluriloculate spindles, 20 to 40 $\mu$ in diameter, were also present in cultures on Sabouraud's agar. After 15 days the surface of the culture was covered with a fine, white down, the periphery being reddish brown. Inoculation tests on rabbits and on human patients gave positive results.

The fungus is considered to represent a transitional phase between *S. ruber* and *T. coccineum*, and the name proposed for it is *S. ruber* var. *yamaguchiense*. *T. coccineum* should also be regarded as a variety of *S. ruber*.

SCHMIDT (P. W.). **Über die Pilzflora Westfalens, insbesondere des Münsterlandes. (Beiträge zur Klinik besonderer Erkrankungsformen bei Pilzerkrankungen, sowie über**

**Doppelinfektionen mit verschiedenen Pilzarten, Züchtung von Mikrosporon audouinii aus dem strömenden Blute).** [On the fungus flora of Westphalia, especially of the Münster district. (Contributions to the clinical study of particular pathological types in fungous diseases, and also on dual infections with various fungus species and the cultivation of *Microsporon audouini* from the blood stream).]—*Arch. für Dermatol.*, clxvii, 2, pp. 418–447, 7 figs., 1933.

A list is given of the dermatophytes isolated from 546 patients examined at the Skin Clinic of Münster University, Westphalia, from 1925 to 1932 (first quarter). *Epidermophyton interdigitale* was found in 38·7 per cent. of the cases and *Achorion schoenleini* in 19, ten other species being less frequent. A species of *Cephalosporium* agreeing with that described by Benedek [ibid., viii, p. 783] was isolated from a number of miscellaneous pathological conditions, its part in the etiology of which is not clear. *Hemispora stellata* [ibid., x, p. 459] was isolated from a chronic ulceration of the nail-bed. Eight cases of dual infections with common dermatophytes are reported and clinical details are given of a number of cases, including two in which *M. audouini* was isolated from the blood stream.

Connor (J. I.). **Favus in mice and men.**—*Med. Journ. of Australia*, xix (ii), 26, pp. 765–767, 4 figs., 1932.

Details are given of the writer's recent investigation of an epidemic of favus affecting mice in the wheat-growing areas of Australia and spreading to the men working at the stacks. The fungus isolated from the lesions both on the mice and on the human subjects was identified as *Achorion quinckeanum* [cf. *R.A.M.*, ix, p. 314], which is believed to have been present at any rate since the similar epidemic in 1917–18, ready to reappear in a virulent form under suitable conditions.

Shaw (F. W.) & Wampler (F. J.). **Mouse favus.**—*Virginia Med. Monthly*, lix, 12, pp. 742–745, 6 figs., 1933.

In December, 1932, an epidemic of favus among mice broke out in a building at Richmond, Virginia, the top floor of which is used for the storage of grain and fodder. Possibly the fungus responsible for the disease (*Achorion quinckeanum*) [see preceding abstract] may have been introduced with shipments from a European country in which the condition is prevalent, either on the grain itself, on the straw used for packing glassware, &c., or on the skin of a mouse. The building in question is situated at least a mile and a half from the local wharf, and no infection has been found in any of the adjacent business houses. Previous literature on the subject of mouse favus is briefly reviewed.

Chavarria (P.) & Rotter (W.). **Die kolumbianische Piedra.** [The Colombian piedra.]—*Arch. für Schiffs- und Tropenhygiene*, xxxvii, 2, pp. 73–87, 16 figs., 1933.

Both *Trichosporum hortai* and *T. giganteum* were isolated in Costa Rica from the authors' twelve cases of 'piedra' of the hair from various parts of Colombia [*R.A.M.*, ix, p. 35]. *T. hortai* is

believed to be the actual agent of the disease, *T. giganteum* being regarded as an accidental contaminant of the cultures. Inoculation experiments on laboratory animals, however, have hitherto given negative results. A comparison of the writers' cultures with six from the Oswaldo Cruz Institute showed that the Colombian strains are identical with those of Brazil and Paraguay.

CARBONE (D.) & CANONICI (O.). **Contribution à la technique de l'agglutination des spores des 'Aspergillus'.** [A contribution to the technique of the agglutination of the spores of '*Aspergillus*'.]—*Boll. Sez. Ital. della Soc. Internaz. Microbiol.*, v, 1, pp. 20–21, 1933.

A technique devised by the authors to secure the agglutination of the spores of *Aspergillus niger* and *A. fumigatus* is briefly described. The spores are suspended in physiological salt solution, centrifuged, and then washed and centrifuged three times in acetone, after which the liquid is decanted and the spores are left to dry in the tube. Physiological salt solution is added, any spore masses are broken up with a glass rod, and filtering is effected through cotton. The suspension should consist of single spores or groups of not more than three, otherwise it must be filtered again. Next, 0·1 c.c. of the freshly prepared spore suspension, to which an equal quantity of the serum to be tested is added, is placed on a slide in an open Petri dish which is rocked gently for a few minutes. When agglutination occurs the spores collect in broad, flat, light masses.

Agglutination was obtained with normal serum, but at much higher concentrations than those (not over 1 in 120 to 1 in 140) required with specific sera.

NANTA (A.) & SENDRAIL (M.). **Reproduction expérimentale des incrustations sidérosiques observées dans les nodules de Gandy-Gamna.** [The experimental reproduction of the siderotic encrustations observed in the nodules of Gandy-Gamna.] —*Comptes rendus Soc. de Biol.*, cxii, 2, pp. 118–120, 1933.

The writers claim to have produced the characteristic siderotic encrustations (Gandy-Gamna nodules) [*R.A.M.*, vii, p. 633] in the spleen of dogs inoculated with *Aspergillus fumigatus*. The culture used in the particular case described was an old one from Biourge's laboratory at Louvain. Similar results have been obtained with *A. nantae* [ibid., ix, p. 779], *A. tunetana* Langeron (which provoked acute splenomegaly), and *A. hortai* Langeron.

DAVIS (F. V.). **Some cases of mildew on silk-cellulose acetate materials.**—*Journ. Textile Inst.*, xxiv, 2, pp. T86–T89, 1933.

An inquiry into the cause of defective dyeing of many samples of cellulose acetate artificial silk fabrics, in which patches of lighter shade occur in the dyed material, showed that these patches yielded consistently more organisms than the normally dyed portions.

The cloth examined was crêpe composed of a cellulose acetate warp (gelatine sized) and a real silk weft. The organisms found were, in addition to several bacteria, two undetermined species of

*Penicillium*, *P. brevicaule*, and (to a limited extent) *Aspergillus niger* and a *Mucor*. Attention is directed to the extreme improbability of the spores, found in an active state after the fabrics had undergone degumming and dyeing, having been introduced subsequently to these processes.

The defect was reproduced on a small scale by storing inoculated silk yarn in contact with cellulose acetate yarn and dyeing the acetate, and on a large scale by weaving a mildewed crêpe weft across a cellulose acetate warp, storing in a damp place for six months, and dyeing.

It is concluded that although cellulose acetate is known to be resistant to the action of micro-organisms [*R.A.M.*, xi, p. 717], it is probable that the micro-organisms present on a silk weft may, either directly or through their metabolic products, affect the dyeing properties and hence the chemical composition of a cellulose acetate warp in contact with the silk. Probably, the gelatine size on the acetate warp favours this development by providing nutriment for the micro-organisms. A fabric of this description in the grey requires dry and not too prolonged storage.

SEVERIN (H. H. P.) & FREITAG (J. H.). **List of ornamental flowering plants naturally infected with curly top or yellows diseases in California.**—*Plant Disease Reporter*, xvii, 1, pp. 1–2, 1933. [Mimeographed.]

Fifteen species of ornamental flowering plants in 14 genera belonging to 11 families have been found naturally infected by curly top [see above, p. 424] in California. After exposure to infected plants, previously non-infective beet leafhoppers (*Eutettix tenella*) transmitted curly top to sugar beets from 11 of these species. The plants were distributed as follows: *Kochia scoparia* var. *trichophylla* (Chenopodiaceae), *Celosia cristata* (Amaranthaceae), *Mirabilis jalapa* (Nyctaginaceae), *Dianthus barbatus* and *D. caryophyllus* (Caryophyllaceae), *Pelargonium hortorum* (Geraniaceae), *Tropaeolum majus* (Tropaeolaceae), *Viola tricolor* var. *hortensis* (Violaceae), *Petunia hybrida* (Solanaceae), *Scabiosa atropurpurea* (Dipsacaceae); *Matthiola incana* and its var. *annua* (Brassicaceae), and four in the Compositae (including *Zinnia elegans* and *Helichrysum bracteatum*).

Three varieties of *Z. elegans* and *H. bracteatum* were further observed to be affected by yellows, which was transferred by leafhoppers (*Cicadula divisa*) [*C. sexnotata*], after feeding on diseased plants, to healthy asters and celery [*R.A.M.*, xii, p. 136].

FREITAG (J. H.) & SEVERIN (H. H. P.). **List of ornamental flowering plants experimentally infected with curly top.**—*Plant Disease Reporter*, xvii, 1, pp. 2–5, 1933. [Mimeographed.]

The curly top disease of sugar beets was experimentally transmitted in the greenhouse by the leafhopper, *Eutettix tenella*, to 90 species of ornamental flowering plants in 72 genera belonging to 33 families [see preceding abstract]. A list is given of the artificially infected plants from which previously non-infective leafhoppers recovered the virus and transmitted it to sugar beets,

including *Humulus japonicus, Reseda odorata, Vinca rosea, S* *splendens, Phlox drummondi, Lobelia cardinalis, L. er* *Papaver nudicaule, P. orientale, Anemone coronaria, Delphi* *nudicaule, Primula* (three species), *Digitalis ambigua, Cucu* *pepo, Lagenaria leucantha, Luffa cylindrica, Trichosanthes anguina, Nicotiana alata, Bellis perennis, Calendula officinalis,* three species each of *Cosmos, Centaurea,* and *Chrysanthemum,* and *Tagetes erecta.*

GRIEVE (B. J.). **Rose diseases and their control.**—*Journ. Dept. Agric. Victoria*, xxx, 11, pp. 553–556, 2 figs., 1932; xxxi, 2, pp. 101–104, 1933.

These final instalments of the author's series of papers on rose diseases throughout the world [*R.A.M.*, xi, p. 784] deal with *Gnomonia rubi*, reported from England [ibid., iv, p. 417], *Botryosphaeria dothidea* (Europe) [ibid., vi, pp. 487, 488], infectious chlorosis or mosaic (North America) [ibid., xi, p. 374], *Eurychora rosicola* (Brazil) [ibid., vi, p. 488], *Hendersonia rosicola* (Brazil) [loc. cit.], *Cryptosporium minimum* (Germany) [ibid., viii, p. 546], *Phoma oleandrina* (France), *Stereum purpureum* (England) [ibid., iii, p. 343; v, p. 502], *Kuehneola rosae* (Japan), *Gloeosporium rosae* (a nomen nudum) [ibid., vi, p. 488], anthracnose (United States) due to *Sphaceloma* [*rosarum*: ibid., xii, p. 96], *Stilbella* sp. on twigs in Trinidad, red rust (*Cephaleuros mycoidea* or *C. parasiticus*) in the West Indies, leaf bronze in England and America, and *Verticillium* wilt (probably *V. ovatum*) in Canada [ibid., xi, p. 245]. The last paper concludes with a brief note on the preparation of the copper and sulphur fungicides commonly used against rose diseases.

LAUBERT (R.). **Die Botryosphaeria-Krankheit (Schwarzschorf) der Rosen.** [The *Botryosphaeria* disease (black scurf) of Roses.]—*Die Kranke Pflanze*, x, 2, pp. 24–25, 1 fig., 1933.

From a well-known rose-garden at Sangerhausen, Germany, the writer recently received specimens of *Rosa alba* and its varieties attacked by black scurf (*Botryosphaeria dothidea*) [see preceding abstract], the importance of which is stated not to be generally realized. The fungus is capable of infecting healthy stems without producing conspicuous injury, but death ensues after four or five years. On the green cortex the lesions appear as round, slightly concave, rugose, black, scattered or confluent areas about ½ to 2 cm. in diameter. In England the Caroline Testout and Soleil d'or varieties are reported to be particularly susceptible. Control measures should be based on the removal of diseased material and the exclusion of susceptible varieties, possibly supplemented by the use of a fungicide.

PAPE (H.). **Krankheiten und Schädlinge der Begonien.** [Begonia diseases and pests.]—*ex* **Die Begonien ihre Beschreibung, Kultur, Züchtung und Geschichte.** [The description, cultivation, breeding, and history of Begonias.]—pp. 149–186, 13 figs., Stuttgart, E. Ulmer, 1933.

Semi-popular notes are given on the symptoms and control of

the following diseases affecting begonias in Germany and elsewhere: propagation disease, associated with *Pythium de Baryanum* [*R.A.M.*, xi, p. 718], *Moniliopsis aderholdi*, *Phytophthora omnivora*, *Thielavia basicola*, *Corticium vagum* [*C. solani*], *Botrytis cinerea*, and other organisms, several of which can also attack the mature plants [ibid., vi, p. 359]; root rot due to *Rosellinia necatrix* (recently reported from France); bacterial rot of the root collar (*Bacillus caulivorus*, a parasitic form of the common saprophyte *B. fluorescens liquefaciens* [ibid., xi, p. 18] occurring in France); crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) [ibid., x, p. 79], from which *Begonia lucerna* appears to be immune; the slime fungus *Physarum gyrosum*, which overgrows the young plants though not a true parasite; leaf bacteriosis of the Gloire de Lorraine variety in Denmark [ibid., viii, p. 752]; rusts (*Coleosporium begoniae* and *Puccinia granularis*), the former in Mexico and Italy and the latter in South Africa; mildew (*Oidium begoniae*), reported from America and Denmark; leaf spots due to *Phyllosticta begoniae* (in France, Italy, Portugal, Germany, and Brazil), *Mycosphaerella begoniae* (Ecuador), *Gloeosporium begoniae* (Italy and North America), *Phyllachora begoniae* (Ecuador), *Cercospora* sp. (Germany and North America), and *Septoria* sp. (Germany); and stem rot of *B. argyrostigma* due to *Myxosporium sordidum* in South America and Europe.

JONES (L. R.) & RIKER (REGINA S.). **Two stem cankers of the China Aster.**—Abs. in *Phytopath.*, xxiii, 1, p. 20, 1933.

China asters in Wisconsin and Illinois were attacked in 1932 by *Phomopsis callistephi* [*R.A.M.*, v, p. 251], the disease caused by which may be distinguished from *Fusarium* wilt [*F. conglutinans* var. *callistephi*: ibid., xii, p. 175] by its cortical rather than vascular localization; its causation of a lateral canker on the aerial stem instead of a basal rot proceeding from the roots; and the production of abundant pycnidia on the diseased stem surface in the later stages. This disease was both prevalent and severe, attacking over half the plants of certain varieties. A species of *Botrytis* caused a stem canker of minor importance under excessively moist conditions.

RIKER (REGINA S.) & JONES (L. R.). **Fusarium strains in relation to wilt of China Aster.**—Abs. in *Phytopath.*, xxiii, 1, pp. 29–30, 1933.

The following results were obtained in tests of the pathogenicity of various European and Japanese strains of *Fusarium* from wilting asters in comparison with *F. conglutinans* var. *callistephi* Beach and Jackson (United States) [*R.A.M.*, xii, p. 373 and preceding abstract]. Pathogenicity was shown by *F. conglutinans* var. *callistephi*, *F. conglutinans* var. *majus* (two strains), *F. oxysporum* f. 6 (four strains), and *F. lateritium* var. *fructigenum* from Europe, and by three unidentified strains from Japan. The Wisconsin wilt-resistant aster varieties maintained their character towards the above-mentioned pathogenic strains.

MASSEY (L. M.), WHITE (R. P.), & JENKINS (A[NNA] E.). **Disease of cultivated sweet Violet caused by Sphaceloma.**—Abs. in *Phytopath.*, xxiii, 1, pp. 22–23, 1933.

Outdoor and greenhouse sweet violets [*Viola odorata*] were severely affected in New York in 1929, and in Pennsylvania in 1932, by an oedema-like disease previously reported from Georgia (1925–7). The stems, peduncles, and petioles may be conspicuously swollen and the leaves distorted. The lesions are generally whitish to vinaceous buff; on the stems, peduncles, and petioles they are linear to elongated, about 5 mm. long, raised or sunken; on the leaves roughly circular, first appearing as minute waterlogged areas, expanding to at least 3 mm. across, often raised on one surface and depressed on the other. The disease is caused by a *Sphaceloma* characterized by hyaline, later coloured, continuous or uniseptate conidiophores 9 to 12 by 2 to 4 $\mu$ in diameter, and hyaline or coloured, spherical to oblong-elliptical conidia, varying in size but often 3 to 7 by 2 to 3 $\mu$. On potato-dextrose agar after three weeks the colonies are raised, wrinkled, and almost black with a dark olive-buff border; on maize meal they are nearly smooth and ochre-red.

HUNGERFORD (C. W.). **A new virus disease of Delphinium in Idaho.**—*Plant Disease Reporter*, xvii, 1, p. 5, 1933. [Mimeographed.]

Delphiniums in various parts of Idaho have been affected during the last two years by a disease of the witches' broom type, characterized by excessive proliferation of the flowering stalk which results in a bunched growth up to 18 in. in diameter. The leaves, petioles, and abortive inflorescences are much dwarfed, though some of the leaves may be extremely elongated. The diseased parts are generally paler than the rest of the plant, and the foliage shows irregular chlorotic areas, while necrotic streaks appear on the stalks and petioles. In the apparent absence of a causal organism the disease is tentatively attributed to a virus [cf. *R.A.M.*, vii, p. 18]. Good control was given by roguing and destroying infected plants.

CAPPELLETTI (C.). **La flora fungina vivente sulle superfici stimmatiche delle piante alpine.** [The fungus flora living on the stigmatic surfaces of alpine plants.]—*Nuovo Giorn. Bot. Ital.*, N.S., xxxix, 4, pp. 690–692, 1932.

The author states that the stigmas of 28 species of alpine plants growing at altitudes between 1,300 and 2,300 m. were found to carry a varied fungal flora, the composition of which depended on the morphology of the floral parts and on the environmental conditions. Among the species of fungi that were isolated, 16 were identified, including *Fusicladium dendriticum* [*Venturia inaequalis*], *Fusarium* sp., *Alternaria tenuis*, and *Botrytis cinerea*, the last-named being only found in sunlit situations and never in shaded spots, except on *Veronica urticaefolia*. There was evidence that the dissemination of the fungi is chiefly effected by insects.

MONTEITH (J.). **A Pythium disease of turf.**—Abs. in *Phytopath.*, xxiii, 1, pp. 23–24, 1933.

*Pythium butleri* [*R.A.M.*, xi, p. 218] was isolated from diseased creeping bent [*Agrostis stolonifera*] turf at Rosslyn, Virginia, in 1926, and shown by greenhouse inoculations to be a vigorous parasite of various grasses, including *A.* and *Poa* spp. Affected patches, up to 4 in. in diameter, first appear blackened and water-soaked but soon shrivel and turn brown; they often coalesce and destroy large areas of turf. The disease has been reported on golf courses and lawns near Washington (D.C.), Philadelphia, St. Louis, Chicago, and elsewhere, being most destructive in hot, damp weather. *P. butleri* can attack plants over a wide temperature range, with an optimum at 35° C. Some degree of control was obtained by spraying the grass with mercuric chloride.

DAHL (A. S.). **Effect of temperature on brown patch of turf.**—Abs. in *Phytopath.*, xxiii, 1, p. 8, 1933.

Five years' observations in Arlington turf garden, Virginia, indicated that the occurrence of brown patch of turf (*Rhizoctonia* [*Corticium*] *solani*) [*R.A.M.*, xi, p. 246] varied directly with temperature. It occurred on 82 per cent. of the days with a minimum above 21° C. The sclerotia of some strains of the fungus were found to germinate at 8°, while all did so at 12° and 36°; the most rapid germination occurred at 28° or 32° and none took place at 40°. A temporary lowering of the temperature did not stimulate germination.

DAVIS (W. H.). **Snow mold and brown patch caused by Sclerotium rhizodes.**—Abs. in *Phytopath.*, xxiii, 1, p. 8, 1933.

Snow mould and brown patch of golf greens, lawns, and meadows are stated to be prevalent in New England, the former having also been reported from 15 States extending as far south as Virginia, west to Idaho, and north to Maine, as well as from Canada. The mycelium of the sclerotial type of snow mould, due to *Sclerotium rhizodes* [*R.A.M.*, xi, p. 499], caused the formation of brown patches. A non-sclerotial type of snow mould also occurred, but was not further studied. Both types generally appeared during the thawing of deep snow of long standing. An average of 175 sclerotia were formed on rhizomes over each square inch of one brown patch. In the field, the sclerotia germinated after a rest period of two months to a year; in the laboratory, stored dry, three months to two years. The mycelium that formed sclerotia was non-pathogenic, while that arising from germinating sclerotia was pathogenic.

FAES (H.), STAEHELIN (M.), & BOVEY (P.). **Les traitements effectués contre les parasites des arbres fruitiers, insectes et champignons en 1930 et 1931.** [The treatments carried out against the insect and fungous parasites of fruit trees in 1930 and 1931.]—*Landw. Jahrb. der Schweiz*, xlvii, 1, pp. 17–76, 26 figs., 5 graphs, 1933. [German summary.]

Better control of apple scab (*Venturia inaequalis*) was given by copper-containing preparations, such as fungan and cupromaag,

than by lime-sulphur, the former also being effective against pear scab (*V. pirina*). All apple varieties liable to contract storage scab should be given a late treatment (six weeks or a month before harvest) in addition to the three earlier ones (pre- and post-blossom and 15 to 20 days later). In March, 1932, the incidence of scab on fruit of the susceptible Franc-Roseau variety (healthy when stored) was only 3 per cent. from trees given five applications of Bordeaux mixture compared with 6 per cent. from those receiving two post-blossom and two late treatments and 50 per cent. where only two post-blossom applications were given.

Shot hole of cherries (*Clasterosporium carpophilum*) [*R.A.M.*, xi, p. 694] is amenable to control by two applications of Bordeaux mixture, care being taken not to exceed a strength of 1 per cent. copper sulphate for fear of injury to the fruit. If 2·5 per cent. lime-sulphur is substituted for Bordeaux mixture the number of applications must be increased.

Gooseberry mildew (*Sphaerotheca mors-uvae*) cannot be adequately combated by a dormant treatment with 1 per cent. formalin or 20 per cent. lime-sulphur, which should be supplemented by three applications of 2·5 per cent. lime-sulphur at fortnightly intervals during the growing period.

Notes are also given on the treatment of plum pockets (*Exoascus* [*Taphrina*] *pruni*), shot hole of peach (*E.* [*T.*] *deformans*), plum rust (*Puccinia pruni-spinosae*) [ibid., xi, pp. 559, 789], and *Monilia* of apricots [*Sclerotinia cinerea*: ibid., xi, p. 791].

Ricks (G. L.) & Toenjes (W.). **Success and failure in spraying for scab and codling moth.**—*Michigan Agric. Exper. Stat. Special Bull.* 230, 29 pp., 15 figs., 2 diags., 5 graphs, 1933.

In connexion with a study of the factors governing success and failure in spraying against apple scab [*Venturia inaequalis*] and codling moth [*Cydia pomonella*] in Michigan [*R.A.M.*, xii, p. 28], the writers describe the methods used and results achieved in scab control in 1929 by two growers whose orchards (consisting chiefly of Baldwins 22 to 28 ft. high) are situated three miles apart.

The spraying outfit used by grower No. 11 maintained a pressure of 250 lb., while that of No. 3 maintained one of 375 lb. Both growers used liquid lime-sulphur ($2\frac{1}{2}$ galls. per 100 of solution) and carried out the spraying operations (1) in the middle of April, (2) first week of May, (3) end of May to beginning of June, and (4) second week in June. Grower No. 3 allowed 17 galls. of solution per tree, while No. 11 gave only 12. The incidence of scab in the orchard of No. 3 was 2·94 per cent. compared with 58·06 in that of No. 11. Field notes taken during the course of the spraying operations showed that in No. 11 orchard the centre tops of the trees were not receiving a sufficient quantity of the fungicide. Early infection occurred on the new leaves in that portion of the trees and spread to the lower foliage and fruit with the dissemination of the spores at every rainy period. On the other hand, in orchard No. 3 all the exposed surfaces were well covered [cf. ibid., xi, p. 522]. Similar observations were made in other orchards, and the conclusion is reached that thoroughness of covering, rather than differences in the spraying schedule or

materials, is the primary factor in the success or failure of the campaign both against *V. inaequalis* and codling moth.

CHEAL (W. F.). **Apple scab spraying experiments in the Wisbech area. The times for application.**—*Journ. Min. Agric.*, xxxix, 11, pp. 993–999, 2 pl., 1933.

After a brief reference to previous work on the control of apple scab [*Venturia inaequalis*] in the Wisbech area of Cambridgeshire [*R.A.M.*, viii, p. 511], the author gives details of experiments in 1931 and 1932, the results of which showed that on the Worcester Pearmain variety three applications of lime-sulphur according to the schedule recommended by Marsh for the Bristol province [ibid., xi, p. 49] gave good control of the disease and produced high quality fruit. These results also demonstrate the importance of the additional pre-blossom application of the spray at the 'green flower' stage in the Wisbech area when lime-sulphur is used throughout, the results, even in such bad scab seasons as those of 1931 and 1932, indicating a marked superiority of scab control from two pre-blossom applications, at the green flower and pink bud stages, respectively, over that given when the former was omitted.

PERRAULT (C.). **The fire blight of Apples on the south shore of the lower St. Lawrence.**—*Twenty-third & twenty-fourth Ann. Repts. Quebec Soc. Protect. Plants, 1930–1932*, pp. 169–170, 1932. [Received May, 1933.]

Out of a total of 112 orchards on the south shore of the St. Lawrence, each containing 50 or more apple trees, 75 were recently infected by fireblight (*Bacillus amylovorus*) [*R.A.M.*, x, p. 737]. In some places the disease occurred in an extremely severe form, necessitating the eradication of a number of trees. Pears, mountain ash [*Pyrus* (?) *americana*], and hawthorn [*Crataegus* sp.] were also found to be infected [cf. ibid., x, p. 603].

STEVENS (N. E.). **United States of America: a survey of Apple rust in 1932.**—*Internat. Bull. of Plant Protect.*, vii, 2, pp. 28–29, 1933.

A recent survey by P. R. Miller and L. R. Fate in Pennsylvania, Maryland, Virginia, West Virginia, North Carolina, and Georgia showed that the rust of apple fruits caused by *Gymnosporangium germinale* is at least equally severe with that due to *G. juniperi-virginianae* [*R.A.M.*, xii, p. 100 and above, p. 423]. The former species, infection by which is restricted to the fruits, primarily affects the Winesap, Delicious, Arkansas Black, Stayman, Yellow Transparent, and Rome varieties, while the latter is most prevalent on Rome, Wealthy, York, Jonathan, Ben Davis, and McIntosh. In a well-cared-for commercial orchard in West Virginia the incidence of infection by *G. germinale* reached 10 per cent. The only other States in which this rust was found were Maryland and Virginia, whereas *G. juniperi-virginianae* was observed throughout the region inspected.

SHEAR (E. V.) & COOLEY (J. S.). **Relation of growth cycle and nutrition to perennial Apple canker infection.**—Abs. in *Phytopath.*, xxiii, 1, p. 33, 1933.

Inoculations at two- to three-weekly intervals for a year with several strains of *Gloeosporium perennans* on apple twigs [*R.A.M.*, xii, p. 179] at Hood River, Oregon, caused infection in normal, living material during only a relatively short period in the autumn and early winter, the maximum infection (100 per cent.) occurring between mid-November and mid-December, after which there was a gradual decline. The internodes were less susceptible than the nodes. Trees receiving either an excess of nitrate or none were more susceptible to the canker than those in good vegetative condition.

SUIT (R. F.). **Studies on a physiological spotting of Apples.**—*Twenty-third & twenty-fourth Ann. Repts. Quebec Soc. Protect. Plants, 1930–1932*, pp. 119–128, 3 pl., 1932. [Received May, 1933.]

In 1931 Fameuse and McIntosh apple fruits at the Oka Agricultural Institute, Quebec, were affected by a distinctive physiological spotting, which was accompanied by a slight reduction of the growth of the twigs and a plugging of the vessels of the roots with a brown substance. Cuttings from the diseased roots showed a diminution of vitality as compared with those from healthy ones, this effect being particularly noticeable in Fameuse. The spots, each of which was surrounded by a cork layer [cf. *R.A.M.*, ix, p. 434], did not spread within the tissues and after 225 days' storage at 40° to 45° F. the fruit was still sound. Chemical analyses showed that the diseased apples were less acid, more highly coloured, with more catalase, oxidase, and peroxidase, and a lower organic peroxide content than the normal fruit.

CHEAL (W. F.). **Control of scab on Pears.**—*Gard. Chron.*, xciii, 2409, p. 139, 1933.

In 1932 one Fertility pear tree in a demonstration plot at Wisbech, Cambridgeshire, was left unsprayed while another was treated as follows against scab [*Venturia pirina*: *R.A.M.*, xi, p. 659]: pre-blossom (4th April) 8–8–100 Bordeaux mixture, and 26th April 1 in 30 lime-sulphur and nicotine; post-blossom (9th May) 1 in 40 lime-sulphur, and 17th and 31st May and 20th June, 8–8–100 Bordeaux mixture, 1 in 60 lime-sulphur, and 1 in 80 lime-sulphur, respectively. The conidia of the fungus were found to be emerging freely from wood pustules on 12th March, when the buds were bursting. On 1st May the sprayed tree displayed nearly double the amount of blossom seen on the untreated, while the total weight of the crop gathered in the third week of September was 74 lb., with 91 per cent. of absolutely clean fruit, compared with 7 lb. 10 oz. for the unsprayed tree, none of the pears from which was entirely free from injury.

VALLEAU (W. D.). **A virus disease of Plum and Peach.**—*Kentucky Agric. Exper. Stat. Bull.* 327, pp. 89–103, 9 figs., 1932. [Received April, 1933.]

During the past six or eight years plum trees at the Experiment Station, Lexington, Kentucky, have been dying from an unknown cause [*R.A.M.*, xii, p. 205]. The trees gradually weaken, and the young leaves are pale, narrow, and curled under in spring and chlorotic, though more normal in shape, throughout the summer. The larger branches die or make little growth, and vigorous water sprouts with an occasional leaf showing distinct patterns of the virus type sometimes grow from near the lower crotches.

The plum orchard adjoins a peach orchard where one Elberta tree since 1925 has annually produced a few 'bumpy' fruits with raised, dark red spots, and many leaves with indefinite chlorotic and necrotic markings. Bumpy fruits were found on other varieties also. Yellows [ibid., xi, pp. 521, 789] has been present in this orchard since 1925 and in 1928 it attacked a small block of peaches 200 yards away. The first fruits to show yellows also showed the 'bumpy' condition. In both orchards some trees produced an occasional bumpy fruit without showing yellows, suggesting that the two diseases may result from different causes and may both be present in the same tree.

Seedling peaches budded with affected plums developed chlorotic ring and line patterns on a few leaves, though their vigour remained unimpaired. Peaches budded with peaches showed no abnormal symptoms except when budded with trees known to be affected with yellows, in which case they developed typical yellows symptoms. These results demonstrated that some of the plum trees at least were affected with a virus transmissible to peach and distinct from the peach yellows virus. Further inoculations were made by budding, using eight varieties of affected plums and three of peach, two of which had yellows. Patterns subsequently appeared on the leaves of nearly all the peaches budded with three of the plum varieties and some of the trees budded with yellows material developed yellows. Buds from some plum varieties showing typical symptoms failed to produce patterns on peach leaves even when unions occurred, while a few patterns developed on peaches budded with a diseased plum variety on which no patterns were observed.

In a commercial orchard Abundance and Endicott plums budded on seedling peaches all showed leaves which were light green, narrow, and rolled downwards, like those at Lexington. Of 74 peach sprouts from the root-stocks examined in one row of the Abundance plums, 39 showed prominent ring and line patterns. In another block of budded trees in which the buds had been taken from the block previously mentioned the leaves of some of the Abundance trees showed prominent concentric yellow and green bands or large yellow areas, frequently visible 30 feet away; of 222 trees examined, 57 showed no leaf patterns and 89 and 76 faint and prominent ones, respectively.

Peach sprouts from the root-stocks of peaches budded with peach in the same nursery showed no patterns, but an occasional small leaf with distinct chlorotic ring and line patterns was found

in the trees. There was some evidence that the plum virus was present in certain peaches.

In budded peaches the virus was able to spread either up or down for at least three feet in eleven months, and it is considered that it probably spreads throughout the tree in that time.

A virus disease showing similar leaf symptoms to those seen on the plum trees was noted on four apple trees at Lexington. On three trees of one species the leaf symptoms were very marked throughout the season, and consisted of chlorotic rings and lines similar to those on peach, and of the same character as the ring spot patterns on tobacco leaves, except that no necrotic patterns were present. Patterns typical of the ring spot type of disease were also noted on one hybrid tea rose, hybrid perpetual roses, and a climbing rose over 12 years old.

The paper terminates with brief recommendations for the eradication of the virus from the nursery.

WILSON (E. E.). **Bacterial canker of Prunus spp. in California.**—Abs. in *Phytopath.*, xxiii, 1, pp. 36–37, 1933.

One of the two organisms associated with bacterial gummosis of plums in California [*R.A.M.*, xi, p. 310] agrees in most cultural and pathogenic characters with *Pseudomonas cerasi*, of which the other is apparently a variant differing only in size from *P. prunicola* described by Wormald from England [ibid., xii, pp. 227, 376]. The cankers of the disease, quiescent for most of the summer, resume activity in the autumn and continue to extend throughout the winter and early spring. The rate of expansion appears to depend, not only on temperature, but also (as indicated by inoculation tests) on the influence of the host itself.

LEHMAN (S. G.). **Bacterial twig and blossom blight of Raspberry.**—Abs. in *Phytopath.*, xxiii, 1, p. 21, 1933.

Young raspberry shoots bearing flowers and half-grown berries examined in 1932 had died back for distances of 1 to 4 in., presenting the general aspect of fireblight (*Bacillus amylovorus*) resulting from blossom infection on apple. The diseased tissues were light brown and exuded numerous white droplets, while some of the leaves showed marginal dead areas bordered by brown, water-soaked tissues containing bacteria. A bacterium isolated from the diseased flower stems proved pathogenic to raspberry and wild blackberry, but not to apple, while conversely an organism believed to be *B. amylovorus* from apple is innocuous to raspberry. Further studies on the relationship between the raspberry blight bacterium and the fireblight organism are necessary.

ANDERSON (H. W.) & KADOW (K. J.). **Anthracnose and gray bark of red Raspberries. Identification and control.**—*Illinois Agric. Exper. Stat. Bull.* 383, pp. 283–292, 7 figs., 1932. [Received May, 1933.]

In 1929 Latham red raspberries in Illinois were severely affected by an apparently new disease locally known as 'gray bark', which recurred in 1931. After the leaves fall in the autumn the canes show a pale grey discoloration, especially on the lower half and on

the south exposure. The grey areas are found, on closer inspection, to consist of numerous small, oval lesions which have fused; these are covered with the concentric, black acervuli of a fungus. The affected bark may be peeled off without any apparent injury to the cane. In the spring of 1932 typical anthracnose (*Plectodiscella veneta*) lesions were found on the fruiting laterals and young shoots. The fungus isolated from the grey bark lesions was found to correspond closely in morphological characters with *P. veneta*, though in cultures the two organisms showed considerable differences. Possibly the anthracnose fungus may comprise various strains. Cross-inoculation experiments on red and black Cumberland raspberries [*Rubus occidentalis*] with the grey bark and anthracnose organisms gave positive results. The grey bark phase of the disease (which is relatively innocuous) may be controlled by a single delayed dormant application of Bordeaux mixture (12–12–100) or lime-sulphur (1 in 12).

TIMS (E. C.). **Stilbum cinnabarinum, the cause of a new Fig disease in Louisiana.**—Abs. in *Phytopath.*, xxiii, 1, p. 35, 1933.

Fig branches sent from Ascension Parish, Louisiana, in May, 1932, were covered with small, reddish-pink fungous heads, borne on short synnemata and consisting of masses of hyaline, unicellular conidia from which pure cultures were readily obtained. Inoculations made on young fig branches through wounds resulted in the formation of the typical heads 20 days later. The fungus rapidly spread through the woody tissues of the twig and into the pithy centre, killing a number of the twigs back to the two-year-old wood after 30 days. The causal organism of the twig blight, which was found to be widespread in the summer of 1932 on the Celeste variety in south-western Louisiana, has been identified as *Stilbum cinnabarinum*. Under normal conditions the disease appears to be of minor importance.

SIMMONDS (J. H.). **Banana leaf spot. Progress report.**—*Queensland Agric. Journ.*, xxxix, 1, pp. 21–40, 2 pl., 1 graph, 1933.

In the first section of this paper the author briefly describes and discusses the results obtained up to 1930 in experiments directed towards finding an adequate method for the control of the banana leaf spot (*Cercospora musae*) in Queensland [*R.A.M.*, viii, p. 255; x, p. 223]. None of the fungicides (mercuric chloride, copper sulphate, or formalin) tested for treating the banana suckers prior to planting had a detrimental effect on the subsequent growth of the plants, but none gave control of the disease, nor did repeated applications to the plants of copper carbonate-sulphur dusts in 1930, presumably owing to the lack of adhesiveness of the dust to the waxy and shiny surface of the leaves, and also to the heavy rains that occur normally during the summer and autumn months. The use of liquid sprays is beset with many practical difficulties in the majority of the Queensland plantations, chiefly because of the steepness of the slopes on which they are situated, and because of lack of a suitable water supply. Although no definite conclusions could be derived from the experiments as to the controlling efficacy

of stripping off the diseased leaves, there was some evidence that satisfactory results may be obtained, without entailing too much labour, by a thorough clean-up of the plantation after the new spring growth has started, followed by a new stripping of the plants in January or early February before the wet season sets in; besides all the spotted leaves, three or even four of the lower healthy ones should also be removed and destroyed. Observations at the Kin Kin Station on the varietal susceptibility of bananas to leaf spot indicated that both the Gros Michel and the Cavendish are markedly susceptible, while the Lady Finger and Sugar varieties appeared to be less affected; the Red Dacca appeared to be definitely resistant, but is of little commercial value at present.

In the second part details are given of a laboratory study of *C. musae*, which confirmed the findings of Campbell [ibid., vii, p. 225] in regard to its identity with the Fiji organism. Although no perfect fructifications developed on any of the culture media tested, dark pycnidium- or perithecium-like bodies, which remained sterile, were formed by most of the strains. In pure culture the optimum for growth appeared to lie between 25° and 26° C., with a maximum and minimum at 32° and 9°, respectively. The optimum for spore germination was about 29°; at lower temperatures, the germination period was lengthened, but after 48 hours a fair percentage of the spores germinated at as low as 15°. A preliminary test indicated that germination practically ceased below 80 per cent. relative humidity. These results are consistent with the rapid development of leaf spot during the early autumn months, when the average temperatures coincide with those favourable to the fungus. Artificial infection experiments showed that both surfaces of the banana leaf are equally susceptible to invasion.

Field observations indicated the existence of three stages in the development of the leaf lesions, which may be distinguished as (1) the early or streak stage, consisting of very light greenish-brown, somewhat indistinct, narrow streaks about 5 to 10 by 1 mm. or less in diameter (many of which, for some reason not yet understood, fail to develop further); (2) the brown stage, in which the spot expands laterally to become elliptical and turns first light and then dark brown to almost black; under favourable conditions spores may be formed when this stage is reached, and this is the only type of lesion on which spores may be expected to be found after the leaf has dried out; and (3) the grey centre stage, in which the elliptical lesion dries out to a light grey, with the bases of the old fructifications showing up as scattered black dots. Under laboratory conditions there was evidence that the spores have not a long period of viability.

The paper terminates with a brief description of two other diseases of the banana leaves observed in Queensland, which on occasions may be responsible for as much loss as leaf spot, and which have been sometimes confused with the latter. The first (termed leaf speckle) is found on the lower leaves usually in the more shaded or crowded situations, and develops on the under surface of the leaves in the form of light grey patches composed of a close speckling of the surface with greyish dots, which, later,

darken and coalesce, and the leaf surface becomes speckled with scattered or aggregated dark brown to black blotches of varying size and intensity, ending in the death of the portions involved. Under favourable conditions, speckle gradually spreads from the lower leaves upwards. It assumes serious proportions earlier in the season than leaf spot, but a rapid epidemic outbreak, such as occurs sometimes with the latter, is not a feature of this disease. Isolations from the lesions fairly consistently yielded an organism, certain strains of which showed cultural characters resembling those of *C. musae*; so far, however, no definite fructifications have been obtained, and the organism has not been identified. A condition resembling speckle was collected by the author from bananas in Ceylon, and appeared to be similar to specimens in the herbarium in Peradeniya, labelled *Leptosphaeria musarum*.

The second leaf disease (termed yellow leaf spot) has only been observed so far in two districts of north Queensland. It first appears in the lower leaves as somewhat indefinite light yellow areas which gradually enlarge to an elongate-elliptical or, more characteristically, a diamond shape. These spots turn deep yellow and then gradually darken in the centre and dry out to dark brown, leaving a narrow yellow margin. The mature spots may be 3 to 4 inches long by 1 to 1·5 inches broad. The disease has essentially the same effect on the plant as leaf spot, but is not quite as serious, except under certain conditions. Associated with this spot is a species of *Scolecotrichum* closely resembling, and considered to be probably identical with, *S. musae* Zimm. [ibid., iii, p. 103].

WILSON (E. E.). **Development and control of Olive knot.**—Abs. in *Phytopath.*, xxiii, 1, p. 37, 1933.

Olive knot [*Pseudomonas savastanoi*: *R.A.M.*, vii, pp. 491, 725; viii, p. 547] is stated to have assumed a serious form in the northern part of the Sacramento Valley [California] within the last four years, affecting chiefly the smaller branches but also the trunks, limbs, leaves, and occasionally the fruits. In certain orchards 95 per cent. of the knots develop at leaf or blossom scars. Inoculation experiments showed that, although infection may occur in December and January, the knots may not appear until March or April. On the other hand, inoculations made in March or April resulted in knot development within a few weeks. Under natural conditions the majority of knots appear in the spring and early summer. Some prospect of control is afforded by three applications of home-made Bordeaux mixture.

GIGANTE (R.). **Ricerche preliminari sôpra un'alterazione non parassitaria delle Olive.** [Preliminary investigation of a non-parasitic disturbance of Olives.]—*Rendic. R. Accad. Lincei*, xvii, Ser. VI, 1, pp. 99–103, 1933.

In this note the author gives an account of his attempt to determine the etiology of a fruit spot of olives which is stated to have been very prevalent in 1932 in the province of Rome, and which in some respects resembled hail injury. The lesion was shown to originate in the mesocarp, certain cells of which undergo lysis for

some unknown reason; as the lytic process extends, rounded or elliptical spots appear on the surface, at first brownish-green but later dark and necrotic, and may attain from 1 to 4 mm. (occasionally up to 6 mm.) in diameter. At an advanced stage the lesion frequently opens up and may reach as far as the stone, when it becomes invaded by secondary organisms, but all isolations before this stage remained sterile. Although the disturbance could not be reproduced under controlled conditions, the fact that the closest approach to it was obtained when olives were subjected to the action of certain vapours, e.g., turpentine, ammonia, and the like, suggests that the trouble may be caused by the presence of some deleterious substance in the atmosphere or in the precipitation water.

ZSCHOKKE (A.). **Unfallverhütung bei der Verwendung von Hochdruckspritzen zur Bekämpfung der Obstbaumschädlinge.** [Prevention of accidents in the use of high pressure spraying apparatus for the control of fruit tree pests.]—*Obst- und Gemüsebau*, lxxix, 2, pp. 27–28, 1933.

Attention is drawn to the risk of accidents to men employed in the manipulation of the high pressure (up to 25 atmospheres) spraying apparatus now in common use in Germany for the control of orchard and vineyard pests. So disquieting had the situation in the Palatinate become in this respect that an inspection of the 2,800 apparatus used in the vineyards was recently ordered, with the result that 135 (6 per cent.) failed to withstand the pressure placed upon them. The machines supplied by one of the firms represented in the inspection were defective to the extent of 13 per cent. Some simple but reliable measures for testing the safety of the apparatus and for the preservation of the latter in good condition are indicated.

WILSON (J. D.) & RUNNELS (H. A.). **Influence of spray materials on transpiration.**—Abs. in *Phytopath.*, xxiii, 1, p. 37, 1933.

Bordeaux mixture checked growth, reduced yield, and increased transpiration and blossom-end rot of tomatoes [*R.A.M.*, viii, p. 426; xi, p. 698], none of which results followed the application of an oil spray [cf. ibid., x, p. 807]. Experimental data indicate that transpiration is accelerated by Bordeaux mixture more during the night than in the daytime. The increases in transpiration caused by some other copper sprays are not comparable with those produced by Bordeaux mixture. If the amount of copper in a given volume of the mixture is kept constant, each additional increment of lime accentuates the influence of the mixture on the transpiration rate until the quantity of lime exceeds that of copper by $1\frac{1}{2}$ times. Bordeaux mixtures prepared with high magnesium and high calcium limes [ibid., xii, p. 391] are equally active in increasing transpiration. This effect does not so readily follow the application of a mixture of hydrated lime and water as of Bordeaux mixture containing an equivalent amount of lime. Mixtures in which the particles remain well in suspension are more active in increasing transpiration than those that settle quickly. Certain other

sulphates in combination with lime enhance transpiration similarly to copper sulphate.

STORCK. **Erd-Dämpfung zur Bodendesinfektion.** [Soil steaming for ground disinfection.]—*Blumen- und Pflanzenbau*, xlviii, 2, pp. 21–23, 3 figs., 1933.

Details are given of the construction and application of the 'Alfa' steamer for soil sterilization (Alfa-Laval-Separator, G.m.b.H., Döberitzerstr. 2, Berlin N.W. 40). By means of this apparatus (No. 120), 400 to 500 l. of soil can be steamed in a working day, steam generation taking place 25 to 30 minutes after firing and continuing for 60 to 70 minutes. The steamer holds 550 10 cm. pots of which 3,000 to 6,000 can be treated in a day. The soil is heated during the process to a temperature of 64° to 98° C., the former near the centre and the latter at the outer edge. The present cost of the steamer is M. 180.

LIMING (O. N.). **The preparation and properties of pentathionic acid and its salts; its toxicity to fungi, bacteria, and insects.**—*Phytopath.*, xxiii, 2, pp. 155–174, 1 diag., 1933.

Sodium, barium, and potassium pentathionates were prepared from concentrated acid formed by the action of hydrochloric acid on sodium thiosulphate [*R.A.M.*, xi, p. 465]. These salts are stable when thoroughly dried and kept at room temperature, but they break down in the presence of moisture and form, among other products, sulphur and sulphur dioxide. On standing, a concentrated solution of pentathionic acid slowly decomposed, forming free sulphur and sulphur dioxide, whereas dilute solutions showed only slight traces of decomposition after six months.

A suspension of hydrophilic colloidal sulphur, prepared by the sulphur dioxide-hydrogen sulphide method [ibid., ii, p. 462], was found, on reduction to a paste, to contain about 47 per cent. free sulphur, 34 per cent. pentathionic acid, and 19 per cent. water. On exposure to the air, sulphur dioxide was formed.

Pentathionic acid was shown to be toxic, in varying degrees, to nine pathogenic fungi, three bacterial pathogens, three species of plant lice, and earthworms. At 0·0068 N the germination of seven of the fungi was completely inhibited, and that of one of the others reduced to 3·3 per cent. Sulphuric acid (0·0068 N) did not appreciably inhibit the growth of these fungi and in the tests on bacteria pentathionic acid was from two to six times more toxic than sulphuric acid.

A few details are given of preliminary tests of the colloidal sulphur as a fungicide, the results of which are regarded as being promising.

HENDEE (ESTHER C.). **The association of termites with fungi.**—*Science*, N.S., lxxvii, 1991, pp. 212–213, 1933.

Representatives of 33 genera as well as 20 undetermined fungi were isolated in California from colonies of three species of termites, *Kalotermes minor*, *Reticulitermes hesperus*, and *Zoötermopsis angusticollis*, some from the exterior of the body and others from their faecal pellets, 'frass', and the wood enclosing their burrows.

*Penicillium* and *Trichoderma* were the genera most frequently encountered, but no evidence was forthcoming of a specific relation between a given fungus and any species of the insects. Termites placed on pure cultures of a fungus were found capable of transporting large masses of spores and hyphae on their legs and bodies, and subsequent dissection revealed these elements in the gut. It was further shown by experiments that the insects may introduce new fungi into wood and also assist in the spread of those already present [cf. *R.A.M.*, ix, p. 279].

DUGGAR (B. M.) & HOLLAENDER (A.). **Ultra-violet radiation.**—Abs. in *Science*, N.S., lxxvii, 1988 (Supplement), p. 26, 1933.

At Wisconsin University the tobacco mosaic virus and cultures of three kinds of bacteria were exposed to the action of ultra-violet rays of a certain narrow range of wave-lengths. The virus was found to resist radiation up to 150 times the amount sufficient to kill one of the bacterial species.

KLAPP (E.) & SPENNEMANN. **Ökologie und Abbau der Kartoffel.** [Ecology and Potato degeneration.]—*Pflanzenbau, Pflanzenschutz u. Pflanzenzucht*, ix, 8, pp. 303–313, 5 maps, 1933.

In connexion with a study of the ecological factors influencing potato degeneration, three separate regions of Germany were investigated from this standpoint [*R.A.M.*, xi, p. 531]. The first shows no tendency to induce degeneration, which occurs to a variable extent in the second and is prevalent in the third. The climate in region No. 1 (average altitude 450 m. above sea level) is mountainous and in No. 3 (170 m.) continental, the soils of the former being fairly heavy ('podsol') and those of the latter soft clay, often with an upper layer of loess or black earth. The conditions in region No. 2 are intermediate between the two extremes. The flora of region No. 1 consists largely of mountain, subatlantic, northern species with many heath plants, and that of No. 3 mainly of continental types with an admixture of introductions from southern Europe.

RICHARDS (B. L.) & BLOOD (H. L.). **Psyllid yellows of the Potato.**—*Journ. Agric. Res.*, xlvi, 3, pp. 189–216, 7 figs., 1933.

This is a detailed account of the authors' investigation up to date of the yellows disease induced in potatoes by the nymphs of the psyllid *Paratrioza cockerelli* [see above, p. 424]. In addition to the information already noticed from previous communications, it is stated that the condition is particularly prevalent in the Washington County of southern Utah, and also in the early potato-growing areas of Davis and Weber Counties of that State; a similar condition has also been reported from the Fruita section in the Grand Junction (western slope) district of Colorado. The disease may develop suddenly in any one season over a vast area, and is capable of extensive and frequently complete destruction of both the early and late crops of potato. Observations indicate that the rate of dissemination of the disease is closely related to the size, motility, fecundity, longevity, and long oviposition period of the females of the psyllid, as well as to the apparent general

distribution of the insect. Preliminary tests showed that hatching the psyllid nymphs on healthy potato leaves in Petri dishes did not reduce their infectivity, but rather increased it, as indicated by the more vigorous symptoms induced by the nymphs so reared on healthy Irish Cobblers, in comparison to the symptoms produced by nymphs of the same age that had been fed on infected potato plants.

While the true nature of the infective principle carried by the nymphs is still unknown, the evidence so far collected would appear to militate against the virus theory of the disease, and would rather suggest the possible existence of some toxic substance which is produced in some way during the feeding process of the psyllid nymphs.

SANFORD (G. B.). **On treating seed Potatoes for the control of common scab.**—*Scient. Agric.*, xiii, 6, pp. 364–373, 2 pl., 1933. [French summary on p. 409.]

As a result of his field and laboratory experiments [details of which are given], the author states that none of the standard potato seed tuber treatments commonly recommended for the control of common scab (*Actinomyces scabies*) which were tested by him, namely, steeping the tubers in hot or cold formaldehyde, mercuric chloride, or Bayer No. 649, was effective in appreciably reducing the disease in the ensuing crops, while the planting of untreated scabby tubers did not increase the amount of scab in the new crop. A slight increase resulted when, prior to planting, the seed tubers were coated with a virulent culture of *A. scabies*, and then only on the new tubers which developed in close proximity to the old inoculated mother tuber. When tubers were set in a soil culture of the parasite, only that part of the tubers which grew in the inoculated soil area was scabbed. It was further shown that in sterilized soil of optimum moisture content *A. scabies* grew vigorously when practically in contact with pieces of potatoes treated as above or coated with sulphur, semesan bel, or Bayer No. 649 dusts.

These results lead the author to consider that the methods now recommended for surface treatment of the seed tubers are of no practical value under ordinary field conditions, where the amount of scab on the new crop appears to depend wholly on the natural infestation of the soil. Further, the fact that under controlled conditions the growth into the surrounding soil of the pathogen, whether it developed from the scabs or from spores on the surface of the tubers, was very definitely restricted to a small area and did not spread far of itself (never more than 2 mm. in three months), raises the question whether the amount of *A. scabies* in the soil is increased by the planting of scabby, untreated potato tubers beyond the increase which normally occurs in nature.

POOLE (R. F.). **Effects of formaldehyde on Ceratostomella fimbriata and the Sweetpotato.**—*Journ. Agric. Res.*, xlvi, 3, pp. 281–290, 4 figs., 1933.

The results of the experiments described in this paper showed that formaldehyde is not a suitable tuber disinfectant for the

control of black rot (*Ceratostomella fimbriata*) of sweet potatoes [*R.A.M.*, xi, p. 535]. Even the weakest concentrations of formaldehyde (1 in 300) tested, quite insufficient to kill the spores of the fungus, caused a definite breakdown of the sweet potato tubers and rendered them very susceptible to attacks of secondary fungi and other organisms which frequently destroyed the tubers or suppressed their germination.

Cross (W. E.). **Notas sobre la cultura agronómica de Tucumán en su régimen y desenvolvimiento en los últimos cincuenta años.** [Notes on the agriculture of Tucumán and its management and development in the last fifty years.]—*Estac. Exper. Agric. de Tucumán Bol.* 20, 56 pp., 15 figs., 1932.

The following references of phytopathological interest occur on pp. 22–3 of this bulletin. During the early part of the 50-year period under review, the sugar-cane crops of Tucumán suffered severe damage from 'polvillo' [lit. 'fine dust': cf. *R.A.M.*, xi, p. 269] or heart rot, which was especially virulent in 1895. It was investigated by Spegazzini shortly afterwards. This disease later declined in intensity, but remained for long an enemy to the cultivation of the susceptible Criollo cane. At the beginning of the present century, mosaic began to cause progressively heavy losses, which reached a climax during 1915–16 but have gradually diminished to negligible proportions since the introduction in 1917 of the resistant P.O.J. 36 and 213 varieties [cf. ibid., vii, p. 400; xi, p. 128].

**Importation of plants regulations. Government Notice 462.**—*Southern Rhodesia Government Gaz.*, 5th Aug., 1932.

The following additional information is given regarding the Southern Rhodesia Importation of Plants Regulations published in Government Notice No. 462 of 5th August, 1932 [cf. *R.A.M.*, xii, p. 399], as regards importations from countries not in the Plant Interchange Schedule. Permits for citrus trees are only to be granted for special varieties not procurable in Southern Rhodesia, and all consignments must be accompanied by an official certificate vouching for their freedom from pests and diseases, particularly canker (*Pseudomonas citri*) which must not have been known at any time within 100 miles of the place of origin. Imported trees are to be kept in quarantine for at least three years.

Tea plant and seed consignments must be accompanied by a certificate guaranteeing the absence of blister blight (*Exobasidium vexans*) from within 10 miles of the area of production.

Maize consignments must not exceed 10 lb. in weight and must be officially certified to originate in districts free from the *Sclerospora* diseases.

Consignments of pome fruit trees, including ornamental species of *Cydonia*, *Pyrus*, and *Malus*, must be certified as originating in premises free from fireblight (*Bacillus amylovorus*).

Cotton seed may only be imported under special justifying circumstances, and permits will be limited to 4 oz. of each variety.

Potato consignments must be accompanied by a certificate to the effect that wart disease (*Synchytrium endobioticum*) does not exist within five miles of their place of cultivation.

All other plants or plant products except fruit, bulbs, tubers, garden vegetables, seeds, and such portions of plants as cannot be propagated shall be allowed only under special permit from the Department of Agriculture. This restriction shall not apply to nursery stock grown in a registered nursery in any of the States in the Plant Interchange Schedule, provided the nurseryman holds a permit from the Department for the introduction of his stock into Southern Rhodesia. The conditions under which these nursery permits will be granted are specified.

Provision is made for the inspection and treatment, if necessary, of all plant imports (including seed) on arrival in the country, and for the destruction without compensation of any deemed dangerous.

**United States Department of Agriculture. Bureau of Plant Quarantine. Seed or Paddy Rice Quarantine No. 55. Revision of quarantine and regulations.**—3 pp., 1933.

In order to prevent the introduction into the United States of certain injurious fungous diseases of rice, including downy mildew (*Sclerospora macrocarpa*), leaf smut (*Entyloma oryzae*), blight (*Oospora oryzetorum*), and glume blotch (*Melanomma glumarum*), the present revision, effective 1st July, 1933, of Quarantine No. 55 [*R.A.M.*, iii, p. 176] (which is hereby superseded) prohibits the importation into the United States from any foreign country (except Mexico, to which special regulations apply) of seed or paddy rice, rice straw, and rice hulls.

**United States Department of Agriculture. Bureau of Plant Quarantine. Packing materials quarantine. Notice of Quarantine No. 69 with regulations.**—3 pp., 1933.

Quarantine No. 69, effective as from 1st July, 1933, prohibits the use for packing purposes of rice straw and rice hulls from all countries on account of the risk of introducing into the United States some of the numerous diseases and pests affecting this crop abroad [see preceding abstract]. Of the other plant substances used for packing prohibited by this quarantine, some are of negligible importance and others are already covered by existing quarantines but are included for convenience. Forest litter, and soil containing an appreciable admixture of vegetable matter, from all countries are also prohibited, except certain types of soil, and peat, peat moss, and *Osmunda* fibre which are considered to be safe. A list is also given of materials that may be used for packing under certain restrictions involving chiefly the right of departmental inspection and of eventual treatment in the interests of safety.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

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MÜLLER (K. O.). **Bemerkungen zur Frage der 'biologischen Spezialisierung' von Phytophthora infestans.** [Observations on the 'biologic specialization' of *Phytophthora infestans*.]—*Angew. Bot.*, xv, 1, pp. 84–96, 1933.

This is a commentary on Schick's conclusions [*R.A.M.*, xii, p. 390] with regard to biologic specialization in *Phytophthora infestans*.

In 1932 the writer obtained infection with the Streckenthin form of the fungus not only on the hitherto immune 'W' strains of potato but also on uncultivated varieties. It had previously been shown by one of the writer's collaborators, Dr. Pfeiffer, that the 'W' strains are not all equally immune from the common form of *P. infestans*, but may be divided into three groups, viz., (1) in which the tubers are susceptible and the fungus reaches the sporulation stage; (2) the parasite penetrates and destroys the tuber parenchyma but seldom forms spores; and (3) the development of the fungus is arrested shortly after entry into the host, and spores are never produced. The reaction of 40 'W' strains to the Streckenthin form of *P. infestans* was tested and in no case did the tubers show the degree of resistance characterizing the above-mentioned groups (2) and (3). Similar results were obtained with a few hybrids of *Solanum demissum* × *S. tuberosum* that had remained practically free from late blight in the field.

Discussing the origin of the Streckenthin form of *P. infestans*, two explanations are offered. It may either represent a permanent modification of the common form with enhanced virulence, or it may be a new biologic form. Schick's results with his *S. demissum* × *S. tuberosum* hybrids undoubtedly lend support to the latter view, though his experimental methods are considered to be open to criticism. Assuming, then, that biologic specialization within *P. infestans* exists, the Streckenthin form may have arisen as a mutant from some individual belonging to the common form. It may, on the other hand, already have coexisted for many years with the common form, but lacked opportunity for extension until the advent of suitable hosts in the shape of the 'W' strains, and of appropriate weather conditions such as prevailed in 1932. A further possibility is that the Streckenthin form was introduced into the v. Kameke seed selection establishment with foreign tubers.

In conclusion, the writer deals at some length with Schick's criticisms of his work and that of other investigators. In any case the 'W' strains have proved their value in respect of immunity from the great bulk of the German types of *P. infestans*, and pending further studies the inference that the fungus comprises sharply defined biologic forms is considered to be premature.

CAIRNS (H.) & MUSKETT (A. E.). **Phytophthora megasperma causing pink rot of the Potato.**—*Nature*, cxxxi, 3304, p. 277, 1933.

In January, 1930, a species of *Phytophthora*, identified by S. F. Ashby at the Imperial Mycological Institute as *P. megasperma*, the agent of a crown rot of hollyhocks in the United States [*R.A.M.*, xi, p. 303], was isolated from decayed potato tubers in Northern Ireland. *P. megasperma*, which differs from *P. erythroseptica* mainly in its large oospores and the production of a preponderance of paragynous antheridia, causes a pink rot indistinguishable from that due to the latter fungus. This is believed to be the first record of *P. megasperma* outside the United States.

COOK (W. R. I.). **On the life-history and systematic position of the organisms causing dry top rot of Sugar-Cane.**—*Journ. Dept. Agric. Puerto Rico*, xvi, 4, pp. 409–418, 3 pl., 1 diag., 1932.

Sugar-cane from Porto Rico affected with the dry top rot previously attributed to *Ligniera vascularum* [*R.A.M.*, viii, p. 603] showed three distinct types of spherical or subspherical spore-like bodies in the cells. The largest were thin-walled, frequently collapsed bodies 16 to 21 $\mu$ in diameter, and occurred almost exclusively in the larger vessels, where they were often so numerous as completely to block the passage. The second type measured 14 to 16 $\mu$ in diameter, had thicker, double-contoured walls, and contained a definite nucleus with one or two nucleoli. This type was less frequent than the first, and was rarely found in the large vessels, though it was present in the phloem, xylem parenchyma, and cortex. In size and structure these bodies corresponded with the spores of *L. vascularum* as described by M. T. Cook [loc. cit.]. The third spore type was irregular in shape, 10 to 12 $\mu$ in diameter, and each, when fully developed, consisted of a number of small spherical nucleated bodies containing a nuclear mass.

There also appeared to be two distinct types of amoeboid material from which the spore types were differentiated. The more easily recognizable type consisted of large masses with no apparent structure or nuclei, and corresponded to plasmodia. They were restricted to the large vessels and formed part of a life-cycle with the largest spore type. The other type consisted of much smaller elements restricted to the phloem and xylem parenchyma and showing structure and nuclei each with a single well-defined nucleolus. Finally, minute, spherical, very deeply staining bodies, probably bacteria, were frequently associated with the three spore types.

The author considers that the organism chiefly responsible for

the disease is the large amoeba and its associated large spore type. This organism he names *Amoebosporus vascularum* gen. et sp. nov. and cites *Plasmodiophora* [*L.*] *vascularum* p.p. as a synonym.

In the earliest stage found, the amoeba consisted of a uniform, undifferentiated mass of protoplasm in the spiral and annular tracheae and the pitted vessels of the vascular bundles. As they became larger the amoebae generally showed no further differentiation, but occasionally the protoplasm developed vacuoles. When mature, the amoebae completely filled the vessel in which they had been growing, and this appeared to stimulate reproduction. The protoplasm became traversed by lines in which solid material was laid down to form the walls of a number of spherical cysts each containing a single, central nucleus surrounded by granular cytoplasm. Later, the nucleus of each cyst split up and a small spherical protoplasmic mass formed round each part, which became a spore by the secretion of a cell wall around it. Eventually the spores were released and were found lying round the empty cysts, embedded in the protoplasm of the original amoeba. As far as the author was able to observe, the spores germinated to produce a small spherical body containing a distinct nucleus with a vacuole, the protoplasm becoming more vacuolated as the amoeba grew; the author is certain that the large amoebae were derived from these spores.

The second organism, *A. saccharinum* sp. nov. (syn. *P.* [*L.*] *vascularum* p.p.), differs from the first chiefly in the smaller size of the amoebae, cysts, and spores. It did not appear seriously to affect the host. The earliest stage found consisted of uninucleate amoebae in some of the cortical cells, phloem, and xylem parenchyma, but never in the xylem vessels. They were irregular in shape and were composed of a very fine granular protoplasm quite distinct from that of *A. vascularum*. The nucleus divided apparently by mitosis. Concurrently with nuclear division the amoeba increased in size. Large plasmodia were not found, though some contained six or seven nuclei. Finally, the amoebae became surrounded by a cyst wall and the contents divided up into small spherical cells containing a single nucleus. In some cases an apical flagellum developed after the spores (which were piriform, later rounded) had emerged from the cyst.

The third type of spore-like body (only occasionally noted) is thought to be possibly a stage in the life-history of some other organism.

The new genus, which bears no relationship to the Plasmodiophoraceae, is placed provisionally in the family Lobosa of the Rhizopoda (Protozoa), in which the pseudopodia are short, blunt, or absent. Latin diagnoses are given of the genus and the two species.

Bourne (B. A.). **Preliminary notes on a leaf disease of Sugar Cane in Florida.**—*Plant Disease Reporter*, xvii, 1, p. 8, 1933. [Mimeographed.]

Brown spot (*Cercospora longipes*) [*R.A.M.*, xi, p. 127] is reported to have been prevalent during the last two years in Florida on certain sugar-cane seedling progenies of Co. 281 × U.S. 1694 (a seedling of P.O.J. 213) e.g., F. 29–362, F. 30–62, and F. 30–64, this being

the first record of the disease in the United States. Some thin-stemmed varieties are so susceptible that the outer half of the foliage presents a blasted appearance due to the innumerable lesions. From the breeder's standpoint the disease has assumed considerable importance in the selection of new seedling varieties. The only commercial variety showing noticeable infection is Co. 281, the thick-stemmed P.O.J. canes, 2714, 2725, and 2878, and the 'noble' S.C. 12/4 being practically immune.

COOK (W. R. I.). **The parasitic slime-moulds.**—*Hong Kong Naturalist Supplement, 1932*, 1, pp. 29–39, 6 pl., 1 fig., 1932.

In order to encourage the search for parasitic slime moulds (Plasmodiophorales) in eastern Asia (whence none of the twelve known species has yet been recorded), the writer gives critical and taxonomic notes on the genera *Plasmodiophora* (with the life-history of *P. brassicae*), *Sorosphaera*, *Sorodiscus*, *Spongospora*, *Tetramyxa*, and *Ligniera* [see next abstract]. The following new combinations are made: *P. diplantherae* (Ferd. & Winge) Cook (= *Ostenfeldiella diplantherae* Ferd. & Winge); and *Spongospora campanulae* (Ferd. & Winge) Cook (= *Clathrosorus campanulae* Ferd. & Winge).

PALM (B. T.) & BURK (MYRLE). **The taxonomy of the Plasmodiophoraceae.**—*Arch. für Protistenkunde*, lxxix, 2, pp. 263–276, 15 figs., 1933.

The recent examination of galls on the subaerial adventitious roots of the main axis and on the petioles of a *Veronica americana* plant in Colorado showed the presence of a number of spore masses of the type of those of *Sorosphaera veronicae*, whereas others displayed equally typical *Spongospora*, *Ligniera*, *Clathrosorus*, or *Sorodiscus* characters [see preceding abstract]. Allowing for considerable intergradation, three groups of spore masses could be distinguished, viz., the hollow sphere type characteristic of *Sorosphaera* (*sensu* Schroeter *non* Fitzpatrick), the flattened ellipsoid or double plate (*Sorodiscus*), and the sponge-like (*Clathrosorus*). The more compact masses may be compared with the typical spore arrangement of *Spongospora*.

In a number of cases the mature spores of the various types were furnished with thickened, verrucose walls, the presence of which has been made the main distinguishing feature of *L. verrucosa* Maire & Tison (*Ann. Mycol.*, vii, p. 226, 1909).

It is apparent from this case and from the literature that the arrangement of the spore masses in this kind of gall is governed by the cellular constitution of the host, and it must therefore be assumed that the several types of aggregation here described belong to a single species of the Plasmodiophoraceae. It would thus seem logical to exclude genera founded purely on such a variable character as spore arrangement, and the following would become synonyms of *Sorosphaera* Schroeter 1886: *Spongospora* Brunchorst 1887, *Ligniera* Maire & Tison 1911, *Sorodiscus* Lagerheim & Winge 1912, *Ostenfeldiella* Ferdinandsen & Winge 1914, *Clathrosorus* Ferdinandsen & Winge 1920, and *Membranosorus* Ostenfeld & Petersen 1930. Of the other allied genera that

have been described, including Woronin's *Plasmodiophora*, only *Cystospora* Elliott would appear to occupy a separate position by reason of its more complicated spore formation. The writers accordingly propose to unite all the hitherto described genera of the family (except *Cystospora*) into one genus which must be known by nomenclatorial rules as *Plasmodiophora* (1878).

Discussing the position of *L. verrucosa*, the authors cannot accept the verrucose cell walls as a diagnostic character considering its presence in certain spore aggregations and absence from others in *V. americana*, so that this species must be regarded as a synonym of *Sorosphaera veronicae*. *L. radicalis*, *S. junci*, and *Sorodiscus callitrichis* are also considered to be identical with *S. veronicae*.

LARSEN (P.). **Fungi of Iceland.**—*ex* The Botany of Iceland, ii, 3, pp. 451–607, 1 col. pl., 20 figs., 1932.

A list, supplemented by critical and taxonomic notes, is given of 802 fungi collected by the writer in Iceland since 1921, special attention having been paid to the Hymenomycetes. There is a supplementary list of six fungi collected by L. Harmsen and S. Steindórsson and sent to the writer by A. Lund. A six-page bibliography and host and fungus indexes are appended.

UNAMUNO (L. M.). **Más especies de hongos microscópicos de nuestro Protectorado marroquí.** [Further species of microscopic fungi from our Moroccan Protectorate.]—*Bol. Soc. Española Hist. Nat.*, xxxiii, 1, pp. 31–43, 6 figs., 1933.

In this second annotated list of Moroccan fungi [cf. *R.A.M.*, xii, p. 395], critical and taxonomic notes are given on 44 species, of which five are considered to be new to science and furnished with Latin diagnoses. *Puccinia gladioli* was found on one leaf only of *Gladiolus illyricus* var. *reuteri*, producing rectangular black spots, 2 to 3 by 1 to 1·5 mm. *Tilletia narduri* n. sp. was found infecting the ovaries of *Nardurus lachenalius* [*Festuca poa*].

MARTYN (E. B.). **Preliminary list of diseases of economic plants in British Guiana.**—*Kew Bull. Misc. Inform., 1933*, 2, pp. 107–110, 1933.

A list is given, in alphabetical order of the hosts, of the fungi and diseases (physiological and virus) affecting 31 plants of economic importance in British Guiana. The records of many of the diseases not observed of recent years are taken from Departmental Reports or from Nowell's 'Diseases of Crop Plants in the Lesser Antilles'.

AGANOSTOPOULOS (P. T.). **Some diseases of fruit trees, vegetables and flowers caused by Fusarium sp. in Greece.**—23 pp., Athens, A. B. Pasca, [? 1932.—Greek, with English summary. Abs. in *Hort. Abstracts*, Imper. Bureau of Fruit Production, iii, 1, p. 15, 1933.]

*Fusarium oxysporum* is stated to be responsible for the following diseases in Greece: blackening of *Pistacia vera*; pear cankers; gummosis of almond, cherry, and apricot; potato and tomato wilts;

chlorosis, root rot, and sterility of broad beans (*Vicia faba*); and onion rot. Species of *Fusarium* are also implicated in stem rot of carnations, and stock [*Matthiola*] and aster wilt [*R.A.M.*, xii, p. 448].

LUDBROOK (W. V.). **Pathogenicity and environal studies on Verticillium hadromycosis.**—*Phytopath.*, xxiii, 2, pp. 117–154, 5 figs., 3 graphs, 1933.

A comprehensive account is given of the writer's studies, conducted at the University of Wisconsin, on the pathogenicity and environmental relations of the agents of hadromycosis of plants, *Verticillium dahliae* and *V. albo-atrum*, the retention of which as separate species is advocated [*R.A.M.*, x, p. 757; xii, p. 117].

Eight cultures of *V. albo-atrum* and 37 of *V. dahliae* were investigated, isolated from 20 different hosts belonging to 17 genera in the United States, Australia, England, and Germany (*V. dahliae* only). Both fungi made approximately equal growth in culture at 22° C., but at 28° the average development rate of *V. albo-atrum* was reduced to about one-quarter of that of *V. dahliae*. The latter organism made varying amounts of growth at 30°, whereas *V. albo-atrum* failed to develop at this point.

Of 15 recorded hosts inoculated with *V. dahliae* under parallel field conditions, severe symptoms were shown by eggplant, okra [*Hibiscus esculentum*], cotton, snapdragon (*Antirrhinum*) [*majus*], and rose; mild ones by wild sumac (*Rhus typhina*), blackberry, and raspberry; and none by potato, tomato, pepper, cucumber, dahlia, lupin, and sweet pea, though the two first named were successfully inoculated under greenhouse conditions. *V. albo-atrum* attacked potato, tomato, and eggplant, the first two showing little or no symptoms except in the greenhouse tests. In soil temperature experiments on eggplants in tanks, *V. dahliae* produced marked signs of infection at a range of 12° to 30°, while *V. albo-atrum* was pathogenic at and below 28°, the air temperature being between 19° and 23° in each case.

No appreciable effect on the severity of hadromycosis in the eggplant was exercised by soil moisture variations between 45 and 95 per cent. of the moisture-holding capacity.

It was found difficult to obtain infection on field-grown plants, especially the relatively resistant tomato and potato, under conditions favouring the development of the disease in soil-temperature tanks. It would appear, therefore, that some factor other than temperature must have lessened the susceptibility of the field-grown plants to the fungi concerned. These facts are discussed in relation to the hypothesis of continuous competition between host and parasite.

JOCHEMS (S. C. J.). **Ziekten der Tabak.** [Tobacco diseases.]—*ex* **Overzicht van de ziekten en plagen der Deli-Tabak in het jaar 1932.** [Survey of the diseases and pests of Deli Tobacco in the year 1932.]—*Meded. Deli Proefstat. te Medan-Sumatra*, Ser. II, lxxxiii, pp. 3–21, 1933.

As in former years, slime disease (*Bacterium solanacearum*) caused the heaviest damage to the Deli tobacco crops in 1932, the incidence of infection among the 57 plantations inspected ranging

from 0·3 to 22·7 per cent. On some of the up-country plantations slime disease assumed an abnormal form recalling top rot (*Bact.* [*Bacillus*] *aroideae*) [*R.A.M.*, xii, p. 332].

Black rust (*Bact. pseudozoogloeae*) [ibid., x, p. 62] was more prevalent than for some years past on up-country plantations, where an abnormally heavy rainfall was experienced in March and the first half of April.

Compared with the losses due to slime disease, those caused by *Phytophthora* [*parasitica*] *nicotianae* [ibid., xii, p. 118] are insignificant. However, in four of the 18 plantations affected by this disease over 100 seed-beds were destroyed. Field observations showed that infection may be carried by river water on to the plantations; five rivers were found to be infected.

Stem scorch (*Pythium* spp.) [ibid., xi, p. 333] was responsible for unusually heavy damage in 45 plantations, where an incidence of 25 per cent. was not uncommon.

Rotterdam B disease [loc. cit.], the most important virus disturbance of Deli tobacco after mosaic, was reported from 17 plantations, 15 of which are on alluvial soils. 'Korab' was observed in five plantations on various types of soil, being much less prevalent, however, than 'gilah' [ibid., xi, p. 478]. 'Daon lidah', characterized by narrow, pointed leaves with a diffuse yellow coloration, affected over 100,000 plants on two plantations in the plains. This disease is evidently also due to a virus; it is transmissible from *Physalis angulata* to tobacco but not always in the reverse direction. Grafting of diseased scions on healthy stocks and vice versa resulted in 100 per cent. infection.

VALLEAU (W. D.). **Seed transmission and sterility studies of two strains of Tobacco ringspot.**—*Kentucky Agric. Exper. Stat. Bull.* 327, pp. 43–80, 12 figs., 1 graph, 1932. [Received April, 1933.]

Two distinct strains of the tobacco ring spot virus [*R.A.M.*, xi, p. 133] are widely distributed in Kentucky, one of which ('green' ring spot) produces the well-known chlorotic green patterns, whereas the other ('yellow' ring spot) produces yellow lines, while the whole leaf bleaches slightly or turns light yellowish-green to nearly white. In suckers of White Burley tobacco after cutting two distinct kinds of symptoms may develop, according to which strain is present. On some plants the suckers may be golden yellow with few or no necrotic rings, whereas on others they may be green with typical rings. Seedlings from seed taken from green ring spot plants usually remained almost normal in appearance, while those from yellow ring spot plants turned yellow soon after germination and had a bleached, yellowish-green appearance throughout growth. On Turkish tobacco plants in the greenhouse the early symptoms following inoculation with the two types were often identical and were characterized by necrotic single, double, or triple rings on the younger, rubbed leaves. In yellow ring spot, however, there soon appeared a marked tendency towards yellowing, especially in the new leaves, and this developed in small (gradually enlarging) spots or as chlorotic, yellowish rings, the neighbouring tissue turning yellow and developing

prominent spots. In green ring spot the chlorotic line patterns sometimes developed in the same way, except that the paler tissue was light green. After the necrotic rings had appeared, plants affected with the green type grew almost normally, but leaves showing the yellow type gradually became chlorotic towards the tip.

As ring spot was not transferred from Cobbler potatoes affected with aucuba mosaic [ibid., x, p. 410] to tobacco by rubbing or grafting, and as the aucuba symptoms differed from those of ring spot, these diseases are considered to be distinct. Both types of ring spot, however, were obtained from naturally affected potatoes and transferred to tobacco. Inoculations of Cobbler potatoes gave negative results by rubbing, but positive results by grafting. Ring spot was transferred to tobacco from *Solanum carolinense*, which appears to be a common carrier of the virus.

Both strains of the virus were transmitted through seed from affected plants. Seedlings affected by the green strain sometimes showed no symptoms unless subjected to abnormally low temperatures. Some plants from infected seed showed none of the usual signs of ring spot, but the older leaves developed small chlorotic patches between the tertiary veins, this chlorosis spreading upwards after the plants bloomed; it is regarded as probably a milder form of the bleaching characteristic of the yellow type.

When young, rapidly expanding leaves of ring spot plants were exposed to low temperatures (50° to 60° F.) the tissues near the margins became chlorotic to necrotic, the leaves later becoming distorted and pinched.

Yellow ring spot seedlings grew slowly and were scarcely suitable for setting in the field, whereas those affected with green ring spot grew rapidly and if set in the field could have served as a source of infection. It is considered that tobacco seed has probably been a factor in the geographical distribution of the green ring spot but not to any significant extent of the yellow ring spot virus. It appears that the fewer the seed produced on diseased plants the higher the percentage of infection. The percentage of seed infection was lower with normal pollen than with pollen from ring spot plants. On the Experiment Station farm, however, seed was not the primary source of green ring spot infection. In years when green ring spot is prevalent, its distribution is not of the random character to be expected from seed transmission, but suggests insect transfer from perennial plants. The presence of yellow ring spot in the plantings could not be attributed to seed transmission.

In view of the little injury caused by ring spot in Kentucky, where in 1931 out of 376,360 plants examined only 0·16 per cent. were affected and most of these not appreciably, the only control measure being considered is the elimination of ring spot plants from crops raised primarily for seed.

The abnormally low seed production of ring spot plants appears to be due to partial pollen sterility resulting from microspore infection. On ring spot plants microspore development appears to be normal for some time after liberation from the tetrad; the walls develop normally and the cytoplasm increases in volume, but most

of the grains are under-sized when the anthers are mature. The veinbanding, healthy potato, tobacco mosaic (severe), and cucumber mosaic type 3 viruses alone or in combination had little or no effect on pollen development. It is suggested that a study of pollen development on an affected plant may indicate whether or not embryo infection is likely to occur with a given virus.

A bibliography of 22 titles is appended.

HENDERSON (R. G.). **Increasing the resistance of Tobacco ring-spot virus to aging in vitro.**—Abs. in *Phytopath.*, xxiii, 1, pp. 14–15, 1933.

A small quantity of carbolic acid added to the expressed juice of ring spot tobacco plants [see preceding abstract] has been found to prevent the ageing of the virus *in vitro*. Virus-infected juice to which sufficient 5 per cent. carbolic acid solution was added to make a concentration of 0·25 per cent. was highly infectious after seven days' incubation at 27° C., whereas the virus in juice treated with toluene was not infectious on the seventh day, and that in untreated juice had lost its virulence by the third.

WOODS (M. W.). **Intracellular bodies in ring spot.**—Abs. in *Phytopath.*, xxiii, 1, p. 38, 1933.

Intracellular bodies, resembling those of tobacco mosaic, have been found in primary and systemic ring spot lesions in Turkish tobacco and in primary lesions in Havana Seed-Leaf, *Nicotiana rustica*, *N. glutinosa*, and *Petunia* [*R.A.M.*, xii, p. 120 and preceding abstracts]. After fixation in formol-acetic alcohol and staining with Fleming's triple stain, the bodies appeared typically granular, vacuolate, with or without membrane-like surfaces, and in *Nicotiana* they sometimes contained minute, red, cuboidal inclusions which were also present in the cytoplasm and nuclei of diseased and healthy cells. Intracellular bodies were found in the cells of the mesophyll, epidermis, and trichomes, their development being apparently directly correlated with the formation of visible foliar lesions. Such bodies were more common in older lesions, though they were also observed five days after inoculation. Tests with Turkish tobacco and *N. glutinosa* failed to reveal the presence in the affected plants of any virus other than that of ring spot.

VALLEAU (W. D.). **A virus disease of Delphinium and Tobacco.** —*Kentucky Agric. Exper. Stat. Bull.* 327, pp. 81–88, 4 figs., 1932. [Received April, 1933.]

Garden varieties of perennial delphinium at Lexington, Kentucky, and Yonkers, New York, are affected by a virus disease somewhat resembling tobacco ring spot [*R.A.M.*, viii, p. 425, and preceding abstracts] but due to a different virus. Chlorotic ring patterns appear on the leaf, following the primary veins. The patterns may or may not be present in spring, but usually become more prominent as the leaves grow older. After blossoming, some or all of the leaves may bleach to a light greenish-yellow.

Inoculations from affected delphiniums to Turkish tobacco plants in the greenhouse gave necrotic ring and line patterns apparently identical with the early symptoms of coarse etch of tobacco [ibid.,

x, p. 60]. If the necrosis on the inoculated Turkish tobacco was very slight the subsequent leaves appeared to be normal or showed occasional faint chlorotic line patterns visible only by transmitted light. If, however, the necrotic patterns were more extensive on the inoculated leaves, the next ones were sometimes distorted as a result of extensive necrotic line patterns and chlorosis. Subsequent leaves were either normal or were small, light green, and slightly distorted, with small, necrotic line patterns here and there. In its general appearance the disease resembled that produced by one of the mild cucumber mosaics. The virus was transferred from tobacco to delphinium by rubbing, and from apparently healthy leaves of affected delphinium to tobacco, on which it again produced the necrotic line disease. The disease was found on tobacco growing in the field in Kentucky and Minnesota: a virus obtained from Burley and Turkish tobacco plant beds at Lexington and from tobacco plants in the field, when transferred to tobacco in the greenhouse, produced a disease quite similar to that produced by the delphinium virus. In White Burley tobacco plants from St. Paul, Minnesota, the author found a virus, either alone or mixed with the veinbanding virus, apparently identical with the delphinium virus in Kentucky; transferred to tomato and cucumber it produced systemic infection. In the last-named host the viruses obtained from delphinium, tobacco plant beds, and a tobacco field in Kentucky, as well as from Minnesota tobacco all produced a conspicuous mosaic.

The delphinium virus, which readily infects cucumbers, differs from that of tobacco mosaic in the symptoms produced, host range, and its inability to withstand drying. It differs from the etch and veinbanding viruses in possessing a wide host range (including members of the Ranunculaceae, Solanaceae, and Cucurbitaceae). It appears to differ from tobacco ring spot in not affecting pollen development or causing sterility, but it resembles it in its wide host range and the patterns produced.

KERLING (L. C. P.). **The anatomy of the 'kroepoek-diseased' leaf of Nicotiana tabacum and of Zinnia elegans.**—*Phytopath.*, xxiii, 2, pp. 175–190, 10 figs., 1933.

The writer's anatomical studies on tobacco leaves affected by the 'common' and 'transparent' types of kroepoek [leaf curl] received from Java [*R.A.M.*, xi, p. 478] are fully described. 'Common' kroepoek is characterized by a disturbance of sugar transport throughout the leaf, even in the externally healthy-looking parts; an increase of the primary phloem in the veins; the enlargement of the pericycle through cell division; the formation of new woody vessels surrounded by a cambium, so that new steles arise inside the old pericycle; and the loss of dorsiventrality in the leaf, in tobacco through the substitution of palisade for spongy parenchyma, and in *Zinnia elegans*, which the writer found affected by a similar disease at Djokjakarta (Java) and which Thung [loc. cit.] has shown to harbour the kroepoek virus, through the formation of a loose, irregular palisade parenchyma with large intercellular spaces. Furthermore, palisade parenchyma and stomata are formed in the lobed veins of the affected tobacco leaf; the lobes after-

wards develop into secondary leaflets [enations] in which the new steles proceed in reverse orientation. These new leaflets lie with the morphological underside against the underside of the old leaf. The increased assimilation brought about by the formation of a new palisade tissue and new laminae cannot fail to augment the quantity of starch, but the amount of calcium oxalate undergoes no alteration.

The 'transparent' type of kroepoek produces in the leaf veins typical swellings of the ends of the xylem vessels and sieve-tubes and enlargement of the pericycle and cortical parenchyma cells. The sieve-tubes are curved and the cell walls of the primary phloem, as well as those of the pericycle, are irregularly swollen. The pericycle breadth is increased from $\pm$ 60 $\mu$ in the normal leaf to $\pm$ 250 $\mu$ in diseased ones, and the individual cells are sometimes up to 120 $\mu$ in diameter. There is much secondary phloem, still apparently functioning.

In spite of the fact that the two types of kroepoek under observation are transmissible by the same insect (a species of *Bemisia* of the family Aleyrodidae), the writer regards them as morphologically and anatomically distinct, and is even inclined to doubt whether the 'transparent' form is correctly classified as kroepoek. The permanence of the two types in inoculation tests points to the implication of two different viruses. The symptoms of 'common' kroepoek correspond with those described by Penzig (Pflanzenteratologie, 2nd edn., 1921–2) as being associated with doubling of the leaf blades and leaf reversion in tobacco (Vol. III, p. 82), and with new ventral and dorsal formations on the midrib of the leaves of other plants (Vol. II, p. 106). Both Penzig and Janse (*Ann. Jard. Bot. Buitenzorg*, xl, p. 87, 1929) refer these teratological manifestations (named by the latter 'splitting phenomena') to abnormalities of the enzymes or growth substances. In the case of kroepoek, the virus transferred by the whitefly causes the splitting of the tobacco leaf and the loss of dorsiventrality in *Z. elegans*. This does not, however, explain how the virus acts in the plant, the first visible deviation in which is an accumulation of starch. Associated with the latter may be the abnormal behaviour of the sieve-tubes and enzymatic disturbances, but the influence of food accumulation on the formation of new steles and on the laminae, with the consequent local loss of dorsiventrality, has yet to be determined.

BORDELEAU (R.). **A few remarks regarding the eradication of the disease known as wild fire in the Tobacco plantations in the Yamaska Valley.**—*Twenty-third and twenty-fourth Ann. Repts. Quebec Soc. Protect. Plants, 1930–1932*, pp. 173–176, 1932. [Received May, 1933.]

By means of stringent sanitary precautions aimed at the prevention of the spread of infection in the field, supplemented by seed-bed disinfection with 1 in 50 formalin ($\frac{1}{2}$ gall. per sq. ft.), tobacco wildfire (*Bacterium tabacum*) is stated to have been completely eliminated from the Yamaska Valley, Quebec, where it caused heavy damage in 1928 [*R.A.M.*, x, p. 132].

DUFRÉNOY (J.). **Modifications pathologiques du métabolisme cellulaire chez les Tabacs.** [Pathological modifications in the cellular metabolism of Tobacco.]—*Ann. des Epiphyties*, xviii, 4, pp. 259–280; 5, pp. 281–316, 1 pl., 29 figs., 1932. [Received May, 1933.]

This fully documented review of the present state of knowledge concerning the cellular constants of the tobacco plant and the variations that may be set up in them, deals with the subject under the following main headings: tobacco seedling growth, the cellular constants, proteogenesis and proteolysis, amylogenesis and amylolysis, effects of ultra-violet rays on tobacco leaves, effects of virus attack on the chondriome and on cellular metabolism, the reaction of the leaves to attack by *Bacterium tabacum*, the effects of various disinfectants on the germination of the seed, and the cytological effects of metabolic disturbances.

The author's own researches on the effects of parasitic diseases of tobacco on the cell contents have been noticed in this *Review* from time to time [cf. *R.A.M.*, x, p. 132; xi, pp. 480, 796, 807].

HOPKINS (J. C. F.). **Mycological notes. Seasonal notes on Tobacco diseases. 5. Evil effects of delayed 'priming'.**—*Rhodesia Agric. Journ.*, xxx, 2, pp. 120–123, 1933.

In 1932 late rains induced much leaf spotting of tobacco all over Rhodesia, frog eye (*Cercospora nicotianae*) [*R.A.M.*, xi, p. 677] being particularly destructive, especially in the curing sheds, while brown spot (*Alternaria tabacina*) [ibid., xi, p. 135] and the shot hole disease due to a species of *Phyllosticta* (possibly *P. nicotiana* or an undescribed form) [ibid., xi, p. 206] completely destroyed a number of late-planted crops in areas where these diseases had not previously been recorded. The author describes how infection spreads from spores present on the lower seed-bed leaves when transplanted to the field and strongly emphasizes the fact that infection can only be checked by the complete removal in December of the lower leaves of the young plants. If the seedlings have become yellow and spotting is general, every unfolded leaf must be removed and the plants stripped to the bud. Priming should not, however, be begun until the plants have put out several new leaves, in order that plants affected by mosaic may be detected and dealt with.

BÖNING (K.). **Über eine zweite Brennfleckenkrankheit des Tabaks, hervorgerufen durch einen Pilz aus der Gattung Gloeosporium Desmaz. et Mont.** [On a second anthracnose disease of Tobacco, caused by a fungus of the genus *Gloeosporium* Desmaz. et Mont.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz*, x, 11, pp. 253–255, 1 fig., 1933.

In September, 1932, the writer examined a sample of tobacco (*Nicotiana rustica*) leaves from Königsberg showing a brown discoloration and a blistered appearance. The fungus isolated from the diseased material resembled *Colletotrichum tabacum*, the causal organism of the tobacco anthracnose which the author described in 1929 [*R.A.M.*, xi, p. 753] but was devoid of setae. Inoculation experiments on *N. rustica* gave positive results after a relatively

lengthy incubation period of four weeks, the older leaves being most severely affected. The organism reisolated from the infected areas again produced conidiophores without setae. In cultural characters the Königsberg fungus also differed from *C. tabacum*, its mycelium being hyaline to light brown, flocculent, and slow growing, in contrast to the greenish-black, pulverulent, and rapidly developing mycelium of the previously recognized agent of anthracnose. The conidia of the species under discussion are, moreover, smaller than those of *C. tabacum*. On account of these differences it is referred to the genus *Gloeosporium* and the provisional name *G. nicotianae* is given to it.

The conidiophores of the second anthracnose fungus measure 6 to 18 by 2 to 7 $\mu$ (older ones up to 12 $\mu$ in width) and the conidia 8 to 18 by 2 to 5 $\mu$. In pure culture rust-coloured to dark brown bodies (probably immature perithecia), 50 to 200 $\mu$ in diameter, may also be observed; they are filled with fatty hyphae but degenerate before reaching maturity.

SWANBACK (T. R.) & JACOBSON (H. G. M.). **Brown root rot of Tobacco.**—*Science*, N.S., lxxvii, 1989, p. 169, 1933.

Laboratory and field investigations in Connecticut have shown that a form of brown root rot of tobacco [*R.A.M.*, xi, p. 496] is due to the insufficient intake of calcium by the plant. This condition may be induced by lack of available calcium, an excess of magnesium over calcium, or the presence of appreciable amounts of ammoniacal in relation to nitrate nitrogen.

KÖHLER (E.). **Viruskrankheiten an Tomaten und Gurken unter Glas.** [Virus diseases of Tomatoes and Cucumbers under glass.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xiii, 2, pp. 11–13, 1933.

A concise summary is given of the available knowledge concerning the virus diseases of glasshouse tomatoes and cucumbers, notes on which have appeared from time to time in this *Review*.

SENGBUSCH (R. v.). **Das Verhalten von Solanum racemigerum gegen den Erreger des Tomatenkrebses (Didymella lycopersici).** [The reaction of *Solanum racemigerum* towards the agent of Tomato canker (*Didymella lycopersici*).]—*Der Züchter*, v, 2, pp. 3–4, 1933.

*Solanum racemigerum*, a wild near relative of the cultivated tomato previously shown to be immune from leaf mould (*Cladosporium fulvum*) [*R.A.M.*, xii, p. 250], was similarly tested under controlled conditions in Berlin for its reaction to canker (*Didymella lycopersici*) [ibid., xii, p. 315]. The latter fungus, however, proved equally destructive on the inoculated plants of the wild and cultivated species at three different stages of growth—three days, three weeks, and two months, all being destroyed while the controls remained healthy. Hitherto none of the tomato forms tested for their reaction to *D. lycopersici* has given any indication of resistance, so that the work of breeding for immunity presents great difficulties.

TIKKA (P. S.). **Metsäpatologisen tutkimuksen tehtävistä suomessa.** [Research problems in connexion with the pathology of forest trees in Finland.]—*Silva Fennica*, 24 (*1932*), 24 pp., 1932. [Finnish, with German summary.]

Following some general observations on the basic principles and problems of phytopathology, with special reference to silvicultural systems, the writer very briefly describes the diseases of forest trees in Finland, arranged in order of causation by climatic, pedological, botanical, zoological, cultural, and various other factors, e.g., those involved in enzymatic, teratological, and hereditary conditions, and the phenomena accompanying adaptation and recovery. The diseases are further grouped according to their localization in the tree: needle, leaf, bud, branch, stem, and root, more exactly defined under the upper and lower crown branches, the basal, middle, and top portions of the stem, and the different parts of the roots. The development and intensity of the diseases are considered in relation to statistical data, and control measures, based on rational silvicultural procedure, are discussed.

ZIEBARTH (F.). **Die hauptsächlichsten starken Schäden an Forstgehölzen im Jahre 1932.** [The principal severe injuries of forest trees in the year 1932.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xiii, 2, pp. 10–11, 1933.

Notes are given on the distribution and prevalence of a number of fungous diseases and insect pests attacking deciduous trees and conifers in German forests during 1932. The numerous reports from Saxony indicate that this province suffered the most severe and extensive injury from these sources.

ROEPKE (W. K. J.). **Kort verslag over het Iepenziekte-onderzoek, verricht op het Laboratorium voor Entomologie te Wageningen, gedurende het jaar 1932.** [A brief report on the Elm disease investigation conducted at the Entomological Laboratory, Wageningen, during the year 1932.]—*Tijdschr. over Plantenziekten,* xxxix, 1, pp. 16–17, 1933.

A summary is given of the investigations in progress at Wageningen on the control of the elm sap beetles [*Scolytus scolytus* and *S. multistriatus*], which are implicated in the transmission of the elm die-back [*Ceratostomella ulmi*], by biological and chemical methods [*R.A.M.*, xi, p. 138; xii, p. 126, *et passim*]. These are still in the experimental stage and no conclusive results are as yet forthcoming.

WESTERDIJK (JOHANNA). **Kort verslag over het Iepenziekte-onderzoek, verricht op het Phytopathologisch Laboratorium 'Willie Commelin Scholten' te Baarn, gedurende 1932.** [A brief report on the Elm disease investigation conducted at the 'Willie Commelin Scholten' Phytopathological Laboratory, Baarn, during 1932.]—*Tijdschr. over Plantenziekten,* xxxix, 1, pp. 17–20, 1933.

During 1932 over 4,000 inoculations were made on American, Asiatic, and European elm seedlings to determine their reaction to *Ceratostomella ulmi* [*R.A.M.*, xi, p. 484]. The tests were conducted in eight localities in Holland and one in Belgium (Antwerp).

As in previous trials, all the American species showed a high degree of susceptibility. *U. laciniata* [var.] *nikkoense* may be added to the list already given of resistant Asiatic species. Most of the European species also proved susceptible to infection by *C. ulmi*, but in the current year's tests three varieties of *U. foliacea* (*dampieri*, *wredei*, and *marmorata*) gave evidence of resistance, as did also *U. monumentalis*, *U. glabra* [var.] *fastigiata*, *U. hollandica* [var.] *vegeta*, and *U. procera*. Some 30 seedlings of *U. glabra* and *U. foliacea* have been selected and will be subjected to further tests in the hope of developing resistance on a commercial scale.

No correlation has been detected between the anatomical structure of the wood and the reaction to *C. ulmi*, and negative results were also given by an attempt to establish a connexion between the extent of transpiration by the foliage and resistance or susceptibility to the disease.

NARASIMHAN (M. J.). **Cytological investigation on the spike disease of Sandal, Santalum album.**—*Phytopath.*, xxiii, 2, pp. 191–202, 2 figs., 1933.

The writer describes the results of his cytological study on spike disease of sandal (*Santalum album*) [*R.A.M.*, xii, p. 129], the annual losses from which in southern India are estimated at nearly 6 to 7 lakhs of rupees [£45,000 to £52,000].

The material used in the investigations was obtained in part from naturally infected areas near the towns of Bangalore and Mysore, supplemented by plants inoculated by grafting and by the pendulous branches characteristic of the 'willow' type of spike occurring in Tumkur [Mysore State]. The intracellular bodies associated with the disease were found to react to Goodpasture's carbolanilin-fuchsin stain (which is stated not to have been previously used in plant virus work) similarly to those found in animal virus diseases, such as rabies and epithelioma contagiosum. They are generally round or oval, often with a wavy outline and small, pseudopod-like projections, and have a maximum diameter of 4·3 to 8·7 $\mu$. The bodies are generally composed of a reticulate matrix containing one or more (up to 11) vacuoles of different sizes. As many as seven proliferations have been observed in some of the intracellular organisms, and it is believed that the minute bodies distributed in certain cells may arise as a result of the cutting off of these processes. No definite evidence of independent movement on the part of the intracellular bodies was obtained.

In the diseased leaf cells the chloroplasts are stimulated to form an excess of starch and in the later stages they disintegrate. The nuclei in proximity to the intracellular bodies present a flattened or dented appearance, and in extreme cases may be crescent-shaped and shrivelled, as in Fiji disease of sugar-cane [ibid., iii, p. 607].

POMERLEAU (R.). **Present status of the White Pine blister rust in the province of Quebec.**—*Twenty-third and Twenty-fourth Ann. Repts. Quebec Soc. Protect. Plants, 1930–1932*, pp. 176–198, 12 figs., 2 maps, 1932. [Received May, 1933.]

Some of the information in this report on the present incidence

and distribution of white pine [*Pinus strobus*] blister rust [*Cronartium ribicola*] in Quebec has already been noticed from another source [*R.A.M.*, xi, p. 553], but the following additional points are of interest. The disease was first observed on gooseberry bushes at St. Anne de Bellevue and Oka in 1916, and on white pines in Portneuf county in 1918. The estimated total volume of white pine in the Province of Quebec is 25 billions f.b.m., which would give a value, at $4·00 per m.f., of $100,000,000 for this species of tree as it stands in the forest. Notes are given on the results of an inspection of the white pine nurseries in certain counties, and on the establishment of a protective zone round the Provincial nursery at Berthierville [cf. ibid., xii, p. 356].

GRASER (H.). **Zur Beurteilung und Abwehr des Tannensterbens.** [On the recognition and prevention of the die-back of Firs.]—*Die Kranke Pflanze*, x, 2, pp. 15–21; 3, pp. 39–42, 1 pl., 3 figs., 1933.

A detailed account is given of the writer's inspection of the silvicultural districts of Saxony in connexion with the die-back of silver firs [*Abies pectinata*: *R.A.M.*, vii, pp. 350, 686], which he attributes primarily to an inadequate water supply and consequent failure of the root system; insects, smoke injury, the attacks of *Armillaria mellea*, and other causes that have been assigned are considered to be purely secondary. Most of the affected areas are hill slopes or plateaux, and the die-back reached its greatest severity after the drought of 1921 and the injury by certain insects in 1922–3. In some localities trees of 70 years or more were mainly affected. Suggestions are made for improvements in the general conditions of the trees.

MARTINEZ (J. B.). **Una grave micosis del Pino observada por primera vez en España.** [A serious mycosis of the Pine observed for the first time in Spain.]—*Bol. Soc. Española Hist. Nat.*, xxxiii, 1, pp. 25–30, 6 figs., 1933.

Young *Pinus pinaster* trees forming part of a reafforestation project on an estate in the municipal district of Rois, Corunna (Spain), near the coast at an altitude of 250 m. above sea level, have been extensively attacked by *Brunchorstia destruens* [*Crumenula abietina*: *R.A.M.*, x, p. 276; xi, p. 757], which also occurred to a lesser extent on *P. insignis* and *P. sylvestris*. The affected area presented the appearance of having been swept by fire owing to the prevalence of yellow, shrivelled needles. The morphology and taxonomy of the fungus, of which this is the first record in Spain, are discussed and control measures briefly indicated on the lines of those practised in Germany against leaf fall [*Lophodermium pinastri*: cf. ibid., viii, p. 685; xii, p. 68].

MIGITA (N.). **Resistance of some woods against the fungus.**—*Cellulose Indus.*, Tokyo, viii, 9, pp. 187–191, 1932. [Japanese, with English abstract, pp. 31–33.]

The results are reported of tests on the resistance to the wood-destroying fungus, *Polyporus vaporarius* [*Poria vaporaria*] of

four kinds of timber, namely, *Thujopsis dolabrata*, chestnut (*Castanea crenata*), *Abies firma*, and beech (*Fagus sieboldi*).

The durability of the wood flours obtained by grinding in a small mill so as to pass through a 1 mm. sieve was determined, after treatment with hot water, alcohol-benzene, or 1 per cent. alkali, by the inoculation of 2 gm. of each sample, soaked in distilled water, with a growing culture of the fungus, which was allowed to develop at 25° C. on the surface of the material for 100 days. After drying at 105° the average losses in dry weight for the different species were as follows: *T. dolabrata*, untreated 0 per cent., hot water 1·12, alcohol-benzene 13·01, and 1 per cent. alkali 10·54, the corresponding figures for chestnut being 0·58, 9·23, 2·50, and 6·19 per cent., for *A. firma* 9·14, 9·11, 11·10, and 5·91 per cent., and for beech 15·99, 14·81, 17·20, and 17·45 per cent., respectively.

Further experiments indicated that the durability of *T. dolabrata* is due to the toxicity to the fungus of its alcohol-benzene-soluble constituent, probably ethereal oil [cf. *R.A.M.*, xi, p. 812], while that of chestnut results from a similar property in its hot water-soluble components. *A. firma* and beech, on the other hand, possess no toxic substances either in their hot water- or alcohol-benzene-soluble constituents.

HUGHES (W.). **A study of Phoma lingam (Tode) Desm., and of the 'dry rot' it causes, particularly in Swede Turnips.**—*Scient. Proc. Roy. Dublin Soc.*, N.S., xx, 34, pp. 495–530, 2 pl., 1933.

A detailed study in Ireland of *Phoma lingam* and dry rot of swedes [*R.A.M.*, xi, pp. 134, 345] showed that the cotyledons, leaves, fleshy roots, siliquas, and seeds are affected. Cunningham's conclusions as to the existence of different strains of the organism [cf. ibid., ix, p. 218] were, in the main, confirmed. Organisms corresponding to his strains I, II, and III and their subdivisions were encountered, but could not always be separated on a basis of parasitic power. Strain I is not homogeneous in respect to its parasitic ability. Fungi isolated from swede seed, while referable on all grounds except parasitism to Cunningham's strain I B, were strongly parasitic to non-growing swede roots in the laboratory. The cultural characters used by Cunningham to separate strains I and II into forms A and B were also found to be somewhat unreliable. There was notable agreement, however, in the fact that the same form of the fungus was ascertained to be responsible for dry rot of swedes in Ireland and New Zealand, and that it fell into strain II. The author found that forms referable to strain II were invariably and exclusively associated with dry rot lesions on the fleshy roots and cotyledons, and with typical lesions on leaves which were not moribund; these were almost invariably II A forms, exactly as appears to be the case in New Zealand, though one II B form, isolated from a diseased cabbage stem, proved strongly pathogenic to swedes in the field. Forms corresponding to strains I and III occurred on dying leaves, roots showing other types of rot, and on the seed, but none of these fungi was able to produce dry rot in the field; III was always saprophytic, and

I at the most occasionally weakly parasitic. A table summarizing the classification according to Cunningham's grouping of over 331 isolations of *P. lingam* studied during a period of four years shows that strain II was isolated 142 times out of 144 from dry rot lesions on the fleshy roots, 35 times out of 35 from cotyledons, 69 times out of 73 from leaf lesions, and 22 times out of 25 from seeds. It is concluded that only strain II is of practical importance in the production of swede dry rot. Strain II B, practically never isolated from any part of diseased swedes except the seed, was yet predominant on all other cruciferous plants examined. This result was rather unexpected, since *P. lingam* as isolated from blackleg of cabbage in America was found in Ireland to belong to strain II A, and both in the laboratory and in the field it produced the severe rot characteristic of this strain in swedes. Limited trials indicated that in Ireland the typical *P. lingam* form of dry rot, corresponding to II A, causes little injury to cabbage stems. The conclusion was drawn provisionally that the comparative absence of cabbage blackleg in Ireland is due not to the absence of the parasite but rather to the fact that local conditions do not favour infection by it. The disease of plants of the cabbage family which does occur ordinarily in Ireland, and with which fungi of strain II B are associated, appears to be less serious than blackleg.

The forms included by Cunningham in his strains I and III differ from II A in their cultural characters rather more widely than does II B from II A, but it was not found possible to distinguish them morphologically. The occurrence in strain I B of a form which in laboratory inoculations was as strongly parasitic as II B to non-growing swede roots and only slightly different from the latter in cultural characters indicates that strain I comes within the limit of the species *P. lingam*; this classification is, however, made only provisionally, as there may be other accepted species of *Phoma* with which it agrees more closely. Thus, some forms included in strain I are morphologically closer to *P. destructiva* (Plowr.) C. O. Jamieson than to *P. lingam* and produce a rapid rot of tomato fruits. As regards strain III, the absence of morphological differences and its close similarity to many forms of strain I make it undesirable at present to separate it from the latter or to constitute a new species to contain it.

*P. lingam* was found in the outer portion of the testas of infected seeds, but not in the embryos of viable seeds.

The progress of dry rot originating from the seed, or from diseased roots of the previous year surviving in the soil or in farmyard manure, is described in detail and the relative importance of these three sources of infection is discussed. Extensive field experiments over a period of three years showed that the amounts of infection usually present on the seed were not capable of producing outbreaks as serious as those which originated from contamination in soil or manure.

Of 42 commercial lots of swede and turnip seed, comprising 164,050 seeds, 10 lots were found to be infected, the proportion of infected seeds averaging only 1 in 6,310. Only a small percentage of disease occurred in plots sown with contaminated seed when

precautions were taken to avoid contamination from the soil or manure, as against percentages exceeding 20 or 30 when contamination from soil or manure occurred.

*P. lingam* grew in sterilized potting soil, but not in unsterilized field soil.

The disease was found to spread extensively in storage pits, the greater part of the rot being due to superficial contamination or incipient lesions present on the roots when brought from the field, but further spread in the pits being favoured by humidity.

On two occasions *P. lingam* was found on charlock (*Sinapis arvensis*) [*Brassica sinapis*], associated with severe attacks on swedes [cf. ibid., x, p. 584].

A bibliography of 23 titles is appended.

WEHLBURG (C.). **Onderzoekingen over Erwtenanthracnose.** [Investigations of Pea anthracnose.]—Thesis, University of Utrecht (Hollandia-Drukkerij, Baarn), 65 pp., 4 pl., 7 figs., 8 graphs, 1932.

Spotting of peas in Holland is produced by three fungi, *Ascochyta pisi* which causes light brown spots, and *A. pinodella* and *Mycosphaerella pinodes*, the spots caused by which are darker brown to black [*R.A.M.*, xi, pp. 345, 759; xii, p. 137]. Of these the first-named was most frequently met with, but the injury caused by *M. pinodes*, which produces foot rot in addition to attacking the leaves, was much more serious. *A. pinodella* is a serious parasite of the hypocotyl and roots. A detailed description of the three fungi is given.

In pure culture experiments using Richards's solution as a base it was found that ammonium salts are a better source of nitrogen for all three fungi than nitrates; on ammonium chloride *A. pisi* attains a greater dry weight than on asparagin or peptone. Nitrite appears to be a good source of nitrogen, provided the nutrient solution has a basic reaction. When ammonium salts of strong acids were used as a source of nitrogen, the reaction of the nutrient solution was reduced to $P_H$ 3·2, below which no growth is possible. Potassium nitrate, on the other hand, induced a rise in the $P_H$ value of the medium to 8.

The development of *A. pisi* was studied at a range of $P_H$ 3 to 9. At $P_H$ 3·2 the fungus forms, in place of normal hyphae, irregular, greenish clumps consisting of thick, round cells, scattered over the surface of the medium. Above this point the growth is satisfactory, the hyphae being normal and covering the substratum with a compact layer. The best sources of carbon for *A. pisi* are dextrin, soluble starch, glucose, and saccharose; on galactose, lactose, and gum arabic growth is less profuse, and cellulose in the form of finely shredded filter paper is not utilized. Magnesium is essential to the growth of *A. pisi*, its omission from the nutrient solution causing almost entire cessation of development. Without phosphorus or sulphur development is poor; the fungus can tolerate very high concentrations (up to 10 per cent.) of phosphate. Calcium seems to stimulate the growth of *A. pisi*, considerably more fungus substance being produced in cultures containing appropriate amounts of calcium nitrate than in those with a

corresponding quantity of potassium nitrate. The optimum hydrogen-ion concentration for *A. pisi* was found to depend not only on the source of nitrogen, but also on that of carbon. With potassium nitrate-saccharose the optimum lies between $P_H$ 4 and 4·9, while with ammonium chloride-saccharose it was from $P_H$ 7·1 to 7·8. The substitution of dextrin for saccharose shifts the optima for potassium nitrate and ammonium chloride to 6·9 and 8, respectively.

The effects of fertilizers on the reaction of peas to attack by *A. pisi*, *A. pinodella*, and *M. pinodes* were investigated. The susceptibility of the host was found to be augmented by the application of nitrogen, phosphorus, and calcium, and lessened by that of potassium. The reproductive activities of the fungi were little affected by the use of fertilizers, except for the failure of pycnidial formation in the total absence of nitrogen.

COOK (H. T.). **Studies on the downy mildew of Onions, and the causal organism, Peronospora destructor (Berk.) Caspary.**—*Cornell Agric. Exper. Stat. Memoir* 143, 40 pp., 9 figs., 1 map, 1 graph, 1932. [Received April, 1933.]

This is a full account of the author's experimental and field studies of onion downy mildew [*R.A.M.*, xi, p. 689] which is stated to be one of the most widely distributed and serious diseases of the crop in most of the chief onion-growing areas of the United States. From a survey of the relevant literature he concludes that the causal organism should be known as *Peronospora destructor* (Berk.) Caspary, under which binomial it was listed by Berkeley in 1860, with a reference to an earlier description of the fungus by him in 1841 under the name *Botrytis destructor*. The specific name *schleideni* was first used six years later, in 1847, by Unger who referred the fungus to *Peronospora* without any mention being made in the Latin diagnosis of its perfect stage, for which reason the name cannot be valid according to the International Code of Nomenclature. In 1860 Berkeley stated that the oospores were known.

Cross-inoculations showed that *Allium schoenoprasum* must be added to the host range of the fungus. No differences were noticed in the relative susceptibility of 53 [named] varieties of common onion which were tested, and it was shown that losses may be sustained at any stage in the life of the plant, and further that the size of the bulbs is considerably lessened by the disease. Field observations indicated that the development of the mildew is favoured by abundant moisture and relatively low temperatures. Commercially grown onions were found to be attacked as early and as frequently on new as on old onion land, the first diseased plants being fairly evenly scattered throughout the fields. There was evidence that the mycelium of the fungus in the onion seed is an important source of primary infection of the ensuing crop.

In the laboratory the fungus fruited over a wide range of temperatures, water on the leaves being a necessary condition for the formation of the conidial fructifications. The spores germinated best in lake water and within temperatures ranging from 3° to 27° C., with an optimum at 11°. The incubation period in the host was about 11 to 15 days.

Control of the disease by spraying or dusting is not considered to be practicable, but the losses caused by it may be minimized by the prevention of the spread of the fungus to new areas, by strict sanitation of the fields, and by regulation of environmental conditions.

FLACHS (K.). **Salatfäule.** [Lettuce rot.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz*, x, 11, pp. 261–264, 2 figs., 1933.

A popular account is given of the lettuce rots caused by *Sclerotinia minor* and *S. sclerotiorum*, of which the former is the more important in Germany [*R.A.M.*, xi, p. 492], affecting both forcing and outdoor plants, frequently to the extent of 50 or 70 per cent. In addition to soil treatment with formalin (2 to 3 per cent.) as previously recommended, the writer advises the application to the beds, some 14 days before planting out, of 0·5 per cent. formalin or 0·25 per cent. uspulun, and the sprinkling of uspulun dust round the seedlings.

DIJKSTRA (G. K.). **Proeven ter bestrijding van Cladosporium cucumerinum Ell. et Arth. in bakkomkommers.** [Experiments in the control of *Cladosporium cucumerinum* Ell. et Arth. in hotbed Cucumbers.]—*Tijdschr. over Plantenziekten*, xxxix, 2, pp. 21–37, 2 pl., 1933. [English summary.]

Full details are given of the writer's experiments, carried out in the glasshouse district of Naaldwijk, Holland, in 1931, in the control of cucumber fruit blight (*Cladosporium cucumerinum*) [*R.A.M.*, xi, p. 690]. The best method of maintaining the constant high soil temperature (26° to 29° C.) necessary to check the disease is by means of hot water pipes, but since artificial heating is not always practicable, an attempt was made to secure similar effects by liberal applications of horse dung. The latter procedure was found to be ineffectual in raising the soil temperature to any extent, and cannot be relied upon to prevent primary infection from the soil, which was shown by inoculation experiments to take place. It did, however, increase the yield and accelerate the maturity of the crop.

*C. cucumerinum* may be controlled by treatment of the soil with 0·4 per cent. commercial formalin or 0·5 per cent. uspulun at the rate of 10 to 15 and 7 to 10 l. per 1·2 sq. m., respectively; the latter preparation, however, is apt to exert an adverse effect on plant growth.

SELLA (M.). **Il tartufo bianco in Istria.** [The white truffle in Istria.]—*Nuovo Giorn. Bot. Ital.*, N.S., xxxix, 2, pp. 155–164, 4 figs., 1932.

In this note the author describes the discovery in Istria of white truffles (*Tuber magnatum* Pico) of the same high culinary qualities as those that exist in Piedmont, and in quantities suggesting that their production may be profitably exploited. The areas of their occurrence, almost confined to the calcareous alluvial soils of the so-called 'white Istria', are indicated, and it is stated that the truffles are most commonly found in association with poplar,

willow, *Quercus robur*, juniper, and in the neighbourhood of *Abies pectinata*, but also in open meadows. Besides *T. magnatum*, Istria produces two other truffles of lesser economic value, namely, *T. borchii* and *T. brumale* [*R.A.M.*, xii, p. 198], and it is thought probable that *T. melanosporum* may also be found eventually to exist there.

LOHWAG (H.). **Über Trüffelvorkommen.** [On the occurrence of truffles.]—*Verh. Zool.-Bot. Gesellsch. Wien*, lxxxii, 1–4, pp. 117–123, 1932.

Attention is drawn to the occurrence of summer truffles (*Tuber aestivum*) [*R.A.M.*, xii, p. 198], a valued delicacy of the Vienna market, in certain fir woods of Lower Austria (Neunkirchen and St. Egyd), where their presence below the soil is indicated by the development, on the corresponding above-ground areas, of hay-coloured 'fairy rings' of *Festuca rubra*. Outside the circles, and strongly contrasting with the latter in their vivid green colour, grew *Poa pratensis* and a number of other plants not belonging to the Gramineae [a list of which is given]. Once the circle indicating the presence of the truffles is recognized, the position of the latter can be determined by the unevenness and cracking of the soil over the buried fungus. The truffle gatherers are expert at finding them from these surface indications.

VERESCIAGHIN (B. V.). **Вредители Виноградной лозы и борьба съ ними. (По наблюденіямъ въ Бессарабіи за 20 лѣтъ 1913–1932).** [Agencies injurious to the Vine and their control (according to observations in Bessarabia from 1913 to 1932).]—16 pp., 1 fig. [on the cover], Cooperativa Agricolă 'Pomona', Chişinău [Kishineff, Bessarabia], 1933.

In this paper the author gives brief notes on the more important pests and diseases of the vine which were observed by him since 1913 in Bessarabia, among which the following may be mentioned. Although the 'esca' disease (*Stereum necator*) [*R.A.M.*, x, p. 221] was first recorded in 1927, it is believed to be of much longer standing in Bessarabia; it is especially prevalent in droughty seasons, such as that of 1930, and appears to be closely related with court-noué. White rot of grapes caused by *Charrinia* [*Coniothyrium*] *diplodiella* [ibid., xii, p. 8] is most serious in hot summers and usually develops after hail injury to the vines, when it may destroy as much as 30 per cent. of the crop. Black rot is caused locally by *Guignardia* [*Physalospora*] *baccae* [ibid., ix, p. 12] and is of minor importance; *G. bidwellii* has not yet been recorded in Bessarabia. Excoriosis (*Phoma flaccida*) [ibid., xii, p. 352] is only serious in certain years, e.g., in 1926, when in some localities up to 30 per cent. of the new growth was affected with it. *Sordaria uvicola* [ibid., x, p. 77] attacks chiefly mature grapes, which it dries up to a condition resembling that of raisins; it only causes minor losses. *Diplodia viticola* [cf. ibid., viii, p. 11] is frequently found on dying vine twigs, but is considered to be rather a saprophyte than a parasite. *Alternaria vitis* [ibid., ix, p. 12] is a very widespread saprophyte, usually following an attack by some primary parasitic fungus on the leaves, twigs, and grapes.

*Trichothecium candidum* [ibid., vii, p. 326] was for the first time observed in 1932 attacking the grapes of certain American self-rooted varieties, on which it formed irregular pinkish spots, and frequently caused the drying-up of whole bunches. [A note on *T. candidum* on grapes is also published, in the Rumanian language, in *Revista Horticola*, Chişinău, No. 118, pp. 159–160, 1932.]

CHABROLIN [C.]. **Le rougeau de la Vigne.** [Rougeau disease of the Vine.]—8 pp., 1 graph, [1933].

The disease known as 'rougeau' or 'rougeat' [*R.A.M.*, x, p. 221; xii, p. 200] on red, and as 'flavescence' on white, grape vine varieties was very prevalent in Tunis in 1932, where it appeared towards the end of July and the beginning of August. The leaves turned red at the edges and rapidly withered and fell, the berries therefore ripening under unsatisfactory conditions. When the autumn rains set in new green shoots were put out, but branches that had been badly affected fell a ready prey to various fungi, including *Sphaeropsis malorum* [*Physalospora cydoniae*]. The disease occurred in patches on low, damp areas and occasionally on hillsides, vines trained on wires and bearing a heavy crop suffering most. The most susceptible varieties were Petit-Bouschet, Alicante-Bouschet, Carignan, and, occasionally Clairette; Alicante-Grenache was remarkably resistant.

The winter had been exceptionally wet, and when growth began the rootlets were badly developed and in a waterlogged and insufficiently aerated subsoil. March, April, and May were very dry, so that the top layers of the soil dried up and the rootlets in them died. The unbalanced accumulation of carbohydrates in the leaves due to the loss of roots resulted in the development of the conditions shown by Ravaz [ibid., iii, p. 505] to lead to rougeau. The root system became unable to provide the leaves with sufficient water, and this (not the rougeau itself) led to desiccation and dropping. Deprived of their leaves, the vines lived on their reserves, which were insufficient to enable the berries to ripen normally.

Affected vines should be pruned well back early in the season, but no attempt should be made to stimulate a normal yield. The old wood should be cut away to benefit the suckers. Vines on which many branches have died should be generously sprayed immediately after pruning with a 30 or 40 per cent. solution of iron sulphate or 3 per cent. Bordeaux mixture. The subsoil should be aerated and the vines well manured, preferably with potassium fertilizers.

WORMALD (H.) & HARRIS (R. V.). **Notes on plant diseases in 1932.**—*Gard. Chron.*, xciii, 2412, pp. 192–193; 2413, p. 213; 2414, pp. 228–229, 1933.

The following information, in addition to that already noticed from other sources, is given on plant diseases investigated at the East Malling Research Station, Kent, during 1932 [cf. *R.A.M.*, xi, p. 21].

Under such conditions as those prevailing in 1932, two pre-blossom sprays are essential for the control of apple scab (*Venturia*

*inaequalis*) [ibid., xii, p. 297]. Infection had already become established at the 'pink-bud' stage. Many spurs of Louise Bonne of Jersey pear trees on a north Kent farm bore withered leaves and flowers; the cracks in the bark were found to contain scab (*V. pirina*) pustules. Infection had evidently taken place in 1931 [cf. ibid., xi, p. 659].

Cherry, plum, and apple trees suffered heavy damage from the blossom wilt fungus (*Sclerotinia cinerea*), the Lord Derby apple variety being particularly susceptible and bearing practically no fruit in some eastern and south-eastern orchards [ibid., xii, p. 99].

*Verticillium dahliae* [ibid., xii, p. 76] was found in the tissues of wilting lupins, in diseased black currant branches, and in quince layers, the last named being apparently a new host. The fungus was further isolated from the discoloured tissues of young pear trees grafted on quince stocks. Leaf blotch of quince (*S. cydoniae*) [ibid., xi, p. 93] caused heavy infection at East Malling, wilting of the young shoots being observed in a number of cases.

Sooty blotch (*Gloeodes pomigena*) [ibid., xii, p. 298, and below, p. 517] was unusually prominent in 1932 on apples, pears, and plums (Warwickshire Drooper, Victoria, and Pond's Seedling).

Extensive mosaic infection was responsible for the failure of a number of Lloyd George raspberry plantations [ibid., x, p. 530], a matter of considerable importance in view of the very heavy demand for this variety for canning. Excellent yields, on the other hand, have been obtained from a series of experimental nurseries on selected Kent and Sussex farms specifically designed for the raising of virus-free canes.

LABROUSSE (F.). **Notes de pathologie végétale.** [Notes on plant pathology.]—*Rev. Path. Vég. et Ent. Agric.*, xx, 2, pp. 71–84, 1933.

In April, 1932, the author isolated *Bacterium solanacearum* from wilted tomatoes grown near Casablanca, Morocco [*R.A.M.*, xi, p. 808]. Inoculations with this strain gave positive results on twenty tomato varieties, *Datura stramonium*, Belle de Fontenay potatoes, *Solanum texanum* [*S. integrifolium*], and *Impatiens balsamina*, but were negative on some twenty other plants known to be susceptible to *Bact. solanacearum*, including five varieties of tobacco, two of *Nicotiana rustica*, *Capsicum annuum*, *Physalis alkekengi*, and *Petunia violacea*.

When 55 spinach varieties were grown in soil artificially contaminated with *Pythium ultimum* [ibid., xi, p. 344] some individual plants alone showed resistance.

Strawberries were affected by three types of dying-off: a leaf roll common on large-fruited, hybrid varieties, especially Madame Moutot, and causing partial or complete shedding of the fruit; a 'frisolée' (crumpled) condition of the leaves characterized by light green, somewhat shrivelled patches with excessive flowering and premature fruit shedding (the Belle de Meaux variety was particularly susceptible to this form); and a dwarfing (noted only on Gaillon plants from Vaucluse) consisting in a progressive and finally very marked stunting of the aerial and subterranean organs, which, however, remained otherwise normal; in very

severe cases the leaves of these dwarfs did not exceed 2 to 3 mm. in length. No organism was associated with any of the conditions, which, from the evidence obtained, appeared to be non-transmissible. They are regarded as physiological in origin and probably due to unsuitable soil and manuring.

In June, 1932, apparently perfectly healthy strawberry plants of a variety resembling Vicomtesse Héricart growing at Baignes (Charente) and bearing numerous well-developed fruits suddenly withered completely. The main roots were almost entirely disorganized and showed the presence of various fungi including *Rhizoctonia* [*Corticium*] *solani* and a *Pythium*.

Collar rot of peas due to separate or combined attacks of *Thielaviopsis basicola* and *Aphanomyces euteiches* [ibid., xi, p. 623] caused heavy losses in one locality in the Seine-et-Oise, the plants withering and dying shortly before being picked. *Bact.* [*Pseudomonas*] *pisi* was obtained from Welcome peas at Sarcelles showing violet-brown spots surrounded by a translucent halo on the pods, leaves, and stalks; the plants died before the pods were fully developed. Inoculations with the bacteria gave positive results on several varieties.

In August, 1932, ring spot [ibid., xi, p. 94] and a form of canker or anthracnose consisting of oblong, depressed, yellowish, later brownish spots on the veins and stalk, were observed on tobacco in the Bas-Rhin, especially on the Rhino-Burley and Cabaud varieties, both diseases usually being present on the same plant. Plants badly attacked by both conditions showed general characteristics closely resembling those of potato streak, including, in particular, marked brittleness. Examination of diseased material obtained in Alsace in 1930 and 1931 failed to show the presence of any pathogenic organism, but inoculations made with the juice from plants showing either of the conditions gave rise to symptoms identical with those seen in nature. Near the points of inoculation pale yellow, circular, sterile spots appeared, while the leaves and young stalks developed necrotic lesions which quickly turned to typical cankers. Typical ring spot appeared on young leaves that subsequently developed. Both conditions are thus to be regarded as manifestations of a single virus disease.

From a heart rot of pineapple buds (Smooth Cayenne and Bouteille varieties) from Guadeloupe the author isolated a strain of *Phytophthora parasitica* var. *microspora* [ibid., vii, p. 602], inoculations with which reproduced the condition on the same varieties but not on Red Spanish pineapples.

Ducomet [V.] & Foëx [E]. **Quelques maladies des plantes cultivées en 1931–1932.** [Some diseases of cultivated plants in 1931–1932.]—*Rev. Path. Vég. et Ent. Agric.*, xx, 2, pp. 55–66, 1933.

In the autumn of 1931 self-sown wheat at Versailles first showed infection by *Puccinia graminis* on 1st November, and by *P. triticina* on 5th November. Owing to an exceptionally mild early winter *P. glumarum* was still present on 15th February following. Inoculations of autumn-sown Noé wheat with *P. glumarum* on 20th November and 5th December 1931 gave rise to pustule

formation on the following 30th December and 6th January, respectively. Ten stools of Noé wheat inoculated with *P. glumarum* on 29th November, 1931 showed a few pustules on 6th January following, 10·7 per cent. infection on 18th January, and 17·5 per cent. infection on 8th February. From 6th to 18th January, 1932 the minimum daily temperature averaged 3° C. and only twice fell below 0°, while the maximum averaged 10°. Between 10th and 15th February severe frosts destroyed the pustules of *P. glumarum* and the leaves bearing them, no further pustules being noted until 14th March, when a few were found on the new shoots in one of the January centres of infection. Wheat sown on 7th October showed the first pustules of *P. glumarum* on 2nd April, infection becoming general on 15th May; the corresponding dates for *P. triticina* were 6th and 27th June. Wheat sown on 15th December showed the first pustules of *P. glumarum* on 17th April, infection becoming general on 20th May; the corresponding dates for infection of this sowing by *P. triticina* were 22nd and 27th June. The spring sowing, effected on 5th March, showed the first infection by *P. glumarum* on 27th April and general infection on 25th May, the corresponding dates for *P. triticina* being 27th June and 15th July. *P. graminis* appeared on wheat at the end of June, 1932, the sowing made on 5th March being that most severely infected. The last-named fungus seriously affected wheat in the vicinity of Dijon, especially the late, heavy-yielding varieties, though P.L.M. I. was relatively unaffected; it also (owing to an exceptionally wet spring and early summer) caused intense infection of cereals in the Bas-Dauphiné and Provence, and in some instances almost entirely destroyed the crops.

Late blight of potatoes (*Phytophthora infestans*), though present in the Seine-et-Oise in June 1932, was subsequently negligible; rain fell in July, but the minimum daily temperature was generally below 10°, and August was marked by drought. Serious losses were, however, caused in Brittany, parts of eastern France, and in the south-west. In Alsace and the Rhone valley early varieties suffered severely, but on others infection was arrested in August as a result of drought. In some localities, such as the mountainous parts of Forez (Loire) the disease persisted throughout August owing to night dews.

At Russ-Hersbach (Bas-Rhin) potato wart disease (*Synchytrium endobioticum*) [*R.A.M.*, x, p. 816] was favoured by hot weather in July, 1932, but was later arrested by drought. Slight spread occurred in the valley of the Bruche, and two new centres of infection were noted at Brumath. Infection was also present in the Vosges mountains, but outside the Bruche valley the areas affected were very limited. The Collin des Vosges and Flucke varieties were resistant.

Following cool, wet weather, tobacco wildfire (*Bacterium tabacum*) [ibid., xi, p. 807] developed in certain parts of south-western France in the spring of 1932. In very wet localities it was present in May and July but was temporarily arrested in June and August; the attacks were resumed in September, apparently owing to mists. In the vicinity of Grenoble the disease appeared late and was unimportant. In the low-lying parts of

Alsace a widespread attack occurred about 25th June and was fairly severe by the end of July, when the middle leaves were affected. In the south of France the first attacks occurred in September. Disinfection of the seed-beds with mixtures containing copper gave good results. There was no evidence of seed transmission.

Perret (C.). **Les maladies des plantes observées en 1932 dans le département de la Loire et particulièrement dans le Haut-Forez.** [Diseases of plants observed in 1932 in the department of the Loire and particularly in Haut-Forez.]—*Rev. Path. Vég. et Ent. Agric.*, xx, 2, pp. 67–70, 1933.

Since 1928, beans growing in the neighbourhood of the Loire have been affected by an apparently seed-borne disease which causes them to wither before flowering; dwarf beans [*Phaseolus vulgaris*] are more susceptible than runner [*P. multiflorus*] varieties.

Owing, in the author's opinion, to over-production the year before, potatoes growing at Merle (Loire) in 1932 were severely attacked by leaf roll [*R.A.M.*, xi, pp. 23, 261]. Late blight [*Phytophthora infestans*: ibid., vii, p. 390] appeared in the same locality (860 m. above sea level) on 30th July, when flowering had scarcely begun, and by 5th September it had destroyed the plantations of susceptible varieties. Infection did not spread concentrically, but progressed steadily. Much of the crop growing at about 350 m. had been destroyed by 20th July. Spread was retarded but not arrested by extremely hot, dry, cloudless weather from 4th to 25th August. In one plot where all the leaves were present on 30th July, 40 per cent. were destroyed by 25th August, and they were all dead by 5th September. Between the two last-named dates the weather was wet with one day of mist. Heavy applications of copper dusts made early in August gave better results than copper solutions, but did not affect the number of affected tubers. In the Loire considerable losses from this disease have been sustained for three years in succession; in 1932 the crop from susceptible varieties grown in the vicinity of Haut-Forez was reduced by 50 per cent.

Rivera (V.). **Rilievi fitopatologici fatti nelle annate 1930–32 al Laboratorio ed Osservatorio di Patologia Vegetale del R. Istituto Superiore Agrario di Perugia.** [Phytopathological records made during the years 1930–32 at the Laboratory and Observatory of Plant Pathology of the Royal Higher Agricultural Institute of Perugia.]—*Riv. Pat. Veg.*, xxiii, 1–2, pp. 1–13, 1933.

Most of the items of phytopathological interest dealt with in this report have already been noticed from other sources [cf. *R.A.M.*, xi, p. 692; xii, p. 82] or are included in separate articles in the present issue [see next abstract and below, pp. 497, 498, 521].

Corneli (E.). **Mal del mosaico su Patate. Ruggine su Grano in autunno. Mal del piombo su Peschi.** [Mosaic disease of Potatoes. Rust of Wheat in autumn. Silver leaf of Peaches.]—*Riv. Pat. Veg.*, xxiii, 1–2, pp. 51–52, 1933.

Potato plants growing in damp localities in the plains near

Perugia became seriously attacked by mosaic in May 1931 and 1932. The aerial growth and the affected leaves were dwarfed, and while few of the plants were killed, the resultant tubers were scanty and small. The attacks, which were sporadic and apparently insect-borne, were not followed by any further extension in either year.

In November, 1932, wheat sown in August and September 800 m. above sea level at Bologna was severely attacked by *Puccinia graminis* [see below, p. 498], the attack, probably owing to heavy rain and marked fluctuations in temperature, reaching epidemic proportions. Perfectly developed uredospores and teleutospores were found on the leaves.

In the autumn of 1932 peach trees at Foligno were attacked by silver leaf disease [*R.A.M.*, vi, p. 395], which caused premature leaf fall.

VILKAITIS (V.). **Naudingųjų augalų ligos ir tų ligų bei kovai su jomis priemonių tyrimas 1927–1932 metais.** [A survey of the work done at the Plant Protection Station from 1927 to 1932.]—*Augalų Apsaugos Stoties 1927–1932 m. darbų apyskaita*, Žemės Ukio Tyrimo Įstaigos Darbai, Kaunas, pp. 7–55, 5 figs., 3 graphs, 1933. [German summary.]

In this paper the author gives an account of the activities of the Dotnuva [Lithuania] Plant Protection Station since its creation in 1927. The bulk of the work has been directed towards the study of the biology of the wheat bunt fungus (*Tilletia tritici*) [*T. caries*] and of its control. It was shown that wheat seed-grain infected with bunt spores that had been subjected to dry heat for one hour at 89° to 90·5° C. produced as many bunted plants as were obtained from seed infected with spores which had been treated for the same length of time at 79° to 81°. Both treatments, however, slightly reduced the incidence of bunt in the ensuing crops, as compared with that produced by seed infected with spores which were not heated. Freezing the spores for 10 hours at −27° C. had no effect on their viability; nor was their viability adversely affected when bunted wheat ears were left in the field throughout the winter, entailing exposure to prolonged frosts as low as −28°. Bunt control experiments showed that disinfection of the seed-grain by steeping is more effective under local conditions than the dry or short disinfection processes, and that the last-named is less effective than dusting the seed with fungicides. It is mentioned that in 1932, presumably owing to the very rainy weather which prevailed during harvest time, the germinability of the wheat seed-grain was very adversely affected by all the disinfectants tested. Three years' tests showed that line no. 2524, locally isolated from Blé rouge de St. Laud (*Triticum vulgare* [var.] *erythrospermum*), was outstanding in its resistance to bunt.

Among the other diseases of cultivated plants briefly dealt with mention may be made of a species of *Fusarium* closely resembling *F. herbarum* [*R.A.M.*, x, p. 513], and having mostly six-celled spores, measuring on the average 50 to 56 by 3·6 $\mu$, which was repeatedly isolated from Lithuanian flax seed; the germinability

of surface-disinfected flax seed which was inoculated with this fungus was either considerably reduced or completely inhibited, and the seedlings raised from such seed showed symptoms of a root disease or were very much retarded in their growth. The flax wilt fungus, *F. lini*, appears to be of rare occurrence in Lithuania.

Attempts to control the finger-and-toe disease of cabbage (*Plasmodiophora brassicae*) by applications of uspulun-universal, germisan, slaked lime, or of a 10 per cent. soda solution were only partially successful on artificially inoculated soil and only in the first year, but failed to give any improvement on soils infected for longer periods. The reaction of soils in which the disease had existed for many years and in which from 60 to 93 per cent. of the cabbages were affected, was found to be $P_H$ 7·6; the lowest $P_H$ value at which finger-and-toe diseased plants were found was 4·1.

MILLER (P. R.), STEVENS (N. E.), & WOOD (JESSIE I.). **Diseases of plants in the United States in 1931.**—*Plant Disease Reporter, Supplement* 84, 65 pp., 13 graphs, 10 maps, 1933. [Mimeographed.]

This report, prepared on the usual lines [*R.A.M.*, xi, p. 770], contains much useful information on the incidence of disease among cereal, forage, and vegetable crops, tobacco, cotton, trees, ornamentals, and fruits and nuts. A map shows the distribution of blister rust (*Cronartium ribicola*) and the range of white or 5-needled pines [*Pinus* spp.] in North America [see above, p. 480].

OSMUN (A. V.). **Department of Botany.**—*Ann. Rept. Massachusetts Agric. Exper. Stat. for the fiscal year ending November 30, 1932* (*Bull.* 293), pp. 15–21, 1933.

The following items of phytopathological interest occur in this report, to which W. L. Doran and E. F. Guba contribute. Tobacco was grown for the tenth successive year in plots last limed in 1923. In 1932 no black root rot (*Thielavia* [*Thielaviopsis*] *basicola*) developed in unlimed plots with a hydrogen-ion concentration of $P_H$ 5·2, but the disease was fairly severe in adjacent limed plots at $P_H$ 5·9 [*R.A.M.*, xi, p. 496]. The average yields per acre were 1,906 lb. in unlimed and 1,559 lb. (18 per cent. less) in limed plots. The persistence of the effects of lime on the incidence of black root rot and the tobacco yield is illustrated by the following figures for crop reductions in the treated plots: 1924, 10 per cent.; 1925, 45; 1926, 43; 1927, 35; 1929, 23; 1930, 25; and 1931, 16. In pot tests infection by *T. basicola* was greatly reduced or prevented by the application to the soil of ammonium thiocyanate at the rate of 900 lb. per acre; at the same time, however, this compound exerted a toxic effect on the tobacco for some 18 weeks after treatment. Brown root rot of tobacco [loc. cit.] was usually more severe in clay than in sandy soils following timothy [*Phleum pratense*] in the cropping system. The addition of timothy to sandy soils was sometimes beneficial to the ensuing tobacco crop.

*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*, the causal organism of downy mildew of cucumbers [ibid., xii, p. 5], was well controlled by spraying with a resin solution (1 in 150 or 1 in 200),

the stock solution being made up of 5 parts each of resin and wood alcohol and 1 of potassium hydroxide.

Downy mildew of lettuce (*Bremia lactucae*) [ibid., xii, p. 417] occurred in a severe form on the previously resistant Bel-May variety; the following percentages of infection were shown by the other varieties tested: Dreer's Wonderful 25, Sutton's Golden Ball 24, Rosy Spring 3, Dreer's Iceberg 1, and Loos Tennis Ball 0. Sporulation in *B. lactucae* was entirely suppressed by dusting infected plants with sulphur dust, while copper-lime-arsenic dust was almost as effective.

The causal organism of eggplant wilt (*Verticillium*) [*albo-atrum*: ibid., xi, p. 626] was found to grow at a range of 50° to 95° F., with an optimum at 78°. The host grew best at a soil temperature range of 77° to 95°, the maximum infection developing at the former point and none at the latter or at 55·4°. The results of field applications of aluminium sulphate and sulphur were not such as to justify the extended use of these compounds, the best means of wilt control evidently lying in cultivation on naturally acid sod land.

The gold leaf disease of strawberries [ibid., xi, p. 496] is associated with chlorophyll degeneration, resulting in poor growth and often in death. Seedlings of Howard 17 develop the typical symptoms of this disorder, which may be avoided by adherence to asexual propagation from the original clone of this variety.

A list (compiled by O. C. Boyd and W. H. Davis) is given of the plant diseases of outstanding importance affecting Massachusetts crops in 1932.

In the report of the Department of Olericulture (pp. 43–45), G. B. Snyder and R. W. Donaldson state that the disorder of swedes known as dark centre or internal breakdown is definitely correlated with a low soil moisture content. Brownish or water-soaked areas develop in the parenchyma tissue between the vascular strands, and in the advanced stages of the disturbance the affected tissue becomes pithy and woody.

**Diseases, insects, and other pests injurious to plants.**—ex *Sixth Bienn. Rept. Kansas Agric. Exper. Stat. for the biennium July 1, 1930, to June 30, 1932*, pp. 85–100, 1932. [Received May, 1933.]

Notes are given on the progress of plant disease investigations in Kansas during the period from 1st July, 1930, to 30th June, 1932. Most of the information has already been noticed in this *Review* from other sources.

TISDALE (W. B.). **Plant pathology.**—*Ann. Rept. Florida Agric. Exper. Stat. for the fiscal year ending June 30, 1932*, pp. 128–148, 1932. [Received June, 1933.]

Further work by A. S. Rhoads on the control of citrus gummosis and psorosis indicated that both diseases are amenable to treatment by the bark-scraping method in the early to intermediate stages [*R.A.M.*, xi, p. 770], this operation being practically useless, however, at a more advanced phase when the underlying bark is already affected and discoloured.

The causal organism of citrus melanose (*Phomopsis citri*) was found by G. D. Ruehle and W. A. Kuntz to be carried over on dead wood into the second spring, though with a progressive reduction of the infection from such wood in the second year. The excision of all dead wood from several heavily infected eight-year-old trees during the winter, however, failed to give commercial control. So far the ascospore isolations of *Diaporthe citri* have only produced the *Phomopsis* stage, whereas another species of *Diaporthe* found on other hosts as well as on citrus gives ascosporal fructifications in culture. During the summer pure cultures of *P. citri* were secured from the buttons of immature citrus fruits, indicating early field infection which is carried over in the button until the fruit is placed in transit or storage. None of the chemical treatments hitherto tested has given as good control of stem-end rot in storage as the removal of the buttons.

Promising results in the control of citrus scab [*Sporotrichum citri*] have been given in a limited number of tests by the application of Bordeaux mixture [ibid., xii, p. 166].

The stems, petioles, peduncles, and fruits of tomato were attacked by *Alternaria solani* [ibid., xii, p. 249], this being apparently the first record of the fungus on the fruits. The spots produced by *A. solani* differ from those due to the 'nail-head' organism [*A. tomato*: ibid., xi, p. 771].

Outstanding resistance to *Fusarium* wilt [*F. niveum*] has been shown in M. N. Walker's experiments by certain selections of Watson, Wonder, Iowa Belle, Iowa King, Pride of Muscatine, and the Iowa hybrids and crosses between some of these watermelon selections [ibid., xii, p. 423].

A. N. Brooks and R. E. Nolen found that strawberry roots, rhizomes, crowns, and fruits are liable to infection by *Sclerotium rolfsii* [ibid., iii, p. 381]. *Colletotrichum fragariae*, the agent of anthracnose of strawberry runners [ibid., x, p. 805], was found to be also responsible for a wilting of the plants and rot of the rhizomes. Inoculation experiments showed that the incubation period for the fungus ranges from a few days in hot weather to several weeks under cooler conditions. The application of 4–4–50 Bordeaux mixture has given good control of the anthracnose phase of the disease.

In a collection of 25 maize varieties planted by R. K. Voorhees on five dates between 4th February and 4th April, the latest planting showed the highest percentage of brown spot (*Physoderma zeae-maydis*) [ibid., xii, p. 431].

WEDGWORTH (H. H.). **Studies relative to plant pathology problems in the Everglades.**—*Ann. Rept. Florida Agric. Exper. Stat. for the fiscal year ending June 30, 1932*, pp. 128–148, 1932. [Received June, 1933.]

Phytopathological investigations in the Everglades region of Florida during the period under review were largely concerned with the field control of powdery mildew [*Erysiphe polygoni*] of beans [*Phaseolus vulgaris*: *R.A.M.*, xi, p. 346], early blight and bacterial spot of celery [*Cercospora apii* and *Bacterium apii*: ibid., x, p. 220; xi, p. 761], early and late blight of potatoes [*Alternaria*

*solani* and *Phytophthora infestans*], leaf blight of carrots (*Macrosporium carotae*) [ibid., x, p. 436], and pepper [*Capsicum annuum*] blight (*P. capsici*) [ibid., xii, p. 112]. Work was also conducted in connexion with the certification of potato seed against virus diseases. Very effective control of the yellowing of beans in alkaline soils (above $P_H$ 6) was obtained by spraying the plants with 0·25 to 1 per cent. solutions of manganese sulphate, four applications being given at ten-day intervals.

GHEORGHIU (I.). **L'immunité et la vaccinothérapie anticancéreuse chez les plantes.** [Immunity and anti-cancerous vaccinotherapy in plants.]—*Comptes rendus Soc. de Biol.*, cix, 15, pp. 1387–1389, 1932.

In order to ascertain the possibilities of conferring immunity from infection by *B[acterium] tumefaciens*, and consequently from crown gall, on *Pelargonium zonale* [*R.A.M.*, xii, p. 148], the writer injected into the stems of several plants large quantities of an emulsion of young agar cultures of the organism heated to complete inactivation at 60° C. Thirty to forty days later the same plants were inoculated with a virulent culture of *Bact. tumefaciens* and kept under observation for ten months, during which period no tumours developed. Check plants similarly inoculated without previous protective injections contracted the typical crown gall symptoms in the usual time.

With a view to testing the efficacy of the injection treatment in plants already infected with crown gall, the writer gave seven or eight applications of the inactivated emulsion of *Bact. tumefaciens*, at five- to six-day intervals, four to six months after inoculation; in some plants the emulsion was applied to the exposed subepidermal tissues on plugs of cotton-wool, while in others six to eight injections were given at five-day intervals with a fine needle in various parts of the plants, including the actual tumours. Immediately following the operation the tumours began to shrivel and eventually disappeared completely, with the result that the plants resumed normal growth and showed no sign of any interference with their normal biological processes. The control plants inoculated at the same time with the crown gall organism developed tumours, lost their chlorophyll, withered, and ultimately died. It is claimed, therefore, that the occurrence of crown gall in *P. zonale* can be not only prevented but cured by appropriate vaccinotherapy.

NEILL (J. C.). **Wheat diseases in New Zealand. Notes on their incidence and control.**—*New Zealand Journ. of Agric.*, xlvi, 3, pp. 137–140, 1 fig., 1933.

Brief, popular notes are given on the symptoms, incidence, and control of the following wheat diseases in New Zealand [cf. *R.A.M.*, vii, p. 224; xi, p. 32]; leaf [brown] rust [*Puccinia triticina*], stem [black] rust [*P. graminis*], loose smut [*Ustilago tritici*], stinking smut [*Tilletia caries* and *T. foetens*], mildew [*Erysiphe graminis*], take-all [*Ophiobolus graminis*], and scab [*Gibberella saubinetii*]. Under New Zealand conditions College Hunter's wheat is apparently immune from loose smut, and Solid Straw Tuscan rarely

shows more than a trace of infection. It is stated that most of the large seed-cleaning plants have now installed dusting machines for the control of stinking smut, so that the seed-grain may be obtained ready dusted.

CORNELI (E.). **Rilievi sullo sviluppo delle ruggini sul Frumento.** [Notes on the development of rusts on Wheat.]—*Riv. Pat. Veg.*, xxiii, 1–2, pp. 17–25, 1933.

In 1929 the first outbreak of *Puccinia triticina* (on Gentil rosso wheat) near Perugia [*R.A.M.*, viii, p. 761] occurred on 1st June, whereas in the two following years the first attacks (on Mentana wheat) were on 9th and 8th May, respectively. Each year *P. graminis* appeared a few days after *P. triticina,* its attack rapidly assuming epidemic proportions, though the spread of the latter fungus became arrested. The delay in the onset of the rusts in 1929 is attributed to retardation in the growth of the wheat due to a late winter and a cool spring. On 6th June, 1929, *P. graminis* attacked a strip of Mentana wheat on either side of which Gentil rosso wheat was at that date unaffected. Mentana being an early variety, and more resistant than Gentil rosso, its greater susceptibility is attributed to the stage of growth reached.

The influence of high temperature and moisture in predisposing wheat to rust is clearly brought out by a study of the local climatic conditions during June, 1929. The average daily temperature was unusually high (22·5° C.) and at first fluctuated considerably; on the 6th it was only 13·5°, but on the 9th it rose to 25·5°. A succession of very hot days followed, when the daily temperature averaged 22° to 26°; light showers fell on the 2nd and 6th, and rain on the 13th, after four fine, hot days when the temperature averaged 24·5° to 26°; finally, the hot, moist conditions became more accentuated, culminating in almost constant rain during the last ten days. On 12th June (the day preceding the first wet one) only very faint traces of infection were present on only a few varieties, but on the 19th, i.e., exactly at the termination of the incubation period (six days) as determined experimentally, very severe infection by *P. graminis* occurred on all the varieties at the experiment station. Wheat growing on the hills was less severely affected than that in the plains where dew and moisture persist longer, and wheat in fields facing east or south-east, so as to receive the rays of the sun in the morning, was less affected than elsewhere.

In the spring of 1930, a limited but marked infection by *Aecidium berberidis* was noted on a clump of *Berberis vulgaris* growing near a place where wheat is threshed annually; no infection was present, however, in the two preceding years or that following. The author's attempts to germinate the teleutospores of *P. graminis* have all failed, and it is believed that their germination is altogether exceptional in Italy.

In Italy the uredospores of *P. graminis* overwinter on wild hosts on which they are able to withstand a temperature of −15°, though an exposure to this temperature for about 15 hours was found greatly to reduce the percentage germination [see next abstract].

BRUSCHETTI (C.). **Sulla capacità germinativa delle uredospore di ruggini del Grano.** [On the germinative capacity of the uredospores of Wheat rusts.]—*Riv. Pat. Veg.*, xxiii, 1–2, pp. 33–36, 1933.

After citing two instances of the infection of wheat by rust [*Puccinia* spp.] during winter in Italy, in one of which Carosello wheat sown in September bore perfectly normal uredospore pustules on 26th December, 1932, and 9th January, 1933, after hard frosts and a period of severe cold, while in the other Romanello wheat sown in August and September at Bologna about 800 m. above sea level was subsequently killed off by rust, the author states that the leaves of *Festuca elatior* after being covered with a layer of ice for several days showed perfectly preserved rust sori bearing uredospores which later gave a high percentage of germination. Uredospores of *P. graminis* kept in hanging drop cultures for 24 hours at $-3°$ C. and then removed to 23° in a thermostat, after 12 hours gave 63 per cent. germination.

Portions of the culms of Carosello wheat bearing rust pustules, and uredospores from the same material in hanging drop cultures, were kept at $-15°$ for about 15 hours and then removed to a temperature at which germination normally occurs. The hanging drop cultures failed to germinate, whereas the uredospores on the host gave about 30 per cent. germination, as compared with 70 to 80 per cent. germination in the case of the controls kept at laboratory temperature (15°). The germinative power of the uredospores remained unimpaired after they had been kept over 45 days in the laboratory.

These results are considered to go far towards explaining the overwintering of the cereal rusts in the region of Perugia.

Unlike what has been reported by other investigators [*R.A.M.*, viii, p. 163; xi, p. 563] light and darkness had no effect whatever on uredospore germination in the author's experiments, though rain water, as compared with distilled, increased percentage germination and accelerated the emission of the promycelial tube.

UKKELBERG (H. G.). **The rate of fall of spores in relation to the epidemiology of black stem rust.**—*Bull. Torrey Bot. Club*, lx, 3, pp. 211–228, 2 figs., 2 graphs, 1933.

A description is given of an apparatus which allowed the author to measure the relative rate of fall in still air of the uredo- and aecidiospores of the four cereal rusts *Puccinia graminis tritici*, *P. g. secalis*, *P. coronata avenae* [*P. lolii*], and *P. triticina*. Statistically significant differences were found between the respective velocities of fall [which are specified] of the spores of the four species, and between the uredo- and aecidiospores of the same species, and from the figures obtained it is calculated that the average theoretical dispersal distance of uredospores that have reached an altitude of 5,000 feet and are being carried by a 30 miles-per-hour wind is 1,000 miles for *P. triticina*, 1,100 miles for *P. g. tritici*, 1,200 miles for *P. g. secalis*, and 1,270 miles for *P. lolii*. The average theoretical dispersal distance of the aecidiospores, based on their velocity of fall, is greater than that of the uredospores.

The average velocity of fall of the uredospores of *P. g. tritici* was approximately 11·5 mm. per second, so that even in the scarcely perceptible breeze of 1 mile per hour the spores would be carried 39 times as fast as their rate of fall in still air, and upward convection currents at any velocity exceeding $\frac{1}{38}$ mile per hour would carry the spores upwards.

MAINS (E. B.). **Host specialization in the leaf rust of grasses, Puccinia rubigo-vera.**—*Papers Michigan Acad. of Science, Arts and Letters*, xvii, pp. 289–394, 1933.

Fifty-six races are recognized by the author in *Puccinia rubigo-vera* on the basis of host specialization, including the forms that have received specific names as *P. alternans*, *P. persistens*, *P. triticina*, *P. agrostidis*, *P. obliterata*, *P. perplexans*, *P. actaeae-agropyri*, *P. actaeae-elymi*, *P. aconiti-rubrae*, *P. dietrichiana*, *P. secalina*, *P. symphyti-bromorum*, *P. bromina*, *P. procera*, and *P. impatientis.*

In this fully tabulated and comprehensive account of the taxonomy and distribution of these rusts in North America, the author points out that the species into which *P. rubigo-vera* has been divided have mostly been based on biologic specialization, though Cunningham and Mains and Jackson [*R.A.M.*, iv, p. 213; v, p. 477] were not prepared to accept this alone as a specific character. *P. glumarum* and *P. anomala* were formerly included in *P. rubigo-vera,* but now that they are recognized as distinct species, there seems to be no reason why the latter name should not be applied to the very prevalent rust on grasses having the general type of leaf [brown] rust of wheat (*P. triticina*) [ibid., xii, p. 151], and which is divisible into a number of races usually accorded specific rank.

It has been shown in these studies that aecidia on species of *Thalictrum* are connected with uredo-teleuto-stages on *Agropyron*, *Bromus*, *Elymus*, *Hordeum*, *Hystrix*, and *Triticum*; on *Clematis* with those on the foregoing except the last named; on *Anemone* with those on *Agropyron*, *Elymus*, and *Hordeum* spp.; on *Delphinium* with those on *A. tenerum*; on *Ranunculus* with those on *Hordeum*, *Poa*, and *Puccinellia* spp.; on *Anchusa* with those on *Secale* sp.; on *Onosmodium* and *Macrocalyx* with those on *Agropyron* and *Elymus* spp.; on *Hydrophyllum* with those on *E.* and *Hystrix* spp.; and on *Impatiens* with those on *Agropyron*, *Elymus*, *Hystrix*, and *Hordeum* spp. [cf. ibid., xii, p. 273].

Lists are given of the aecidio-, uredo-, and teleutospore hosts of the races of *P. rubigo-vera*, and of the races of the latter with their synonyms and related species, and a four-page bibliography is appended.

GASSNER (G.). **Neue Wege zur Bekämpfung des Weizenflugbrandes durch Beizung.** [New methods for the control of loose smut of Wheat by steeping.]—*Phytopath. Zeitschr.*, v, 5, pp. 407–433, 1933.

A fully tabulated account is given of the writer's experiments in the control of loose smut of wheat [*Ustilago tritici*] by varying periods of immersion (up to 24 hours) in hot water (35°, 40°, or

45° C.) or by moistening the seed-grain with water of the same temperatures in closed containers at 5, 6, 7½, or 10 l. per cwt., the duration in this case being up to 14 hours [*R.A.M.*, vii, p. 155].

The efficacy of the hot-water treatment was found to be largely dependent on the exclusion of oxygen, this being a prerequisite condition for intramolecular respiration and the formation of alcohol and other cleavage products in the interior of the plant parts undergoing disinfection, to the action of which, in the author's opinion, the disinfection is partially or wholly due. On this assumption an attempt was made to improve the present technique by the addition to the water of alcohol solutions at concentrations of 2 to 5 per cent. Under these conditions it was found possible considerably to curtail the duration of the treatment, and preliminary tests indicated that by increasing the temperature to 50° still better results may be obtained in a shorter time. No diminution in the efficacy of the alcohol solutions was observed after repeated use. Besides pure ethyl alcohol, methylated spirit and isopropylalcohol proved definitely effective in reducing the period necessary for smut elimination, while promising results were also given by acetone, cyclohexanone, dioxane, methyl alcohol, glycol, glycol-monethyl ether, and glycol-monobutyl ether.

At a temperature of 45°, infection by *U. tritici* was reduced to a trace by the moistening process (six hours), while the addition of alcohol resulted in complete elimination at this heat and in a marked increase in the efficacy of the treatment at 35° and 40°.

CLARK (J. A.), QUISENBERRY (K. S.), & POWERS (LE R.). **Inheritance of bunt reaction and other characters in Hope Wheat crosses.**—*Journ. Agric. Res.*, xlvi, 5, pp. 413–425, 2 graphs, 1933.

This is an account of the results [largely presented in the form of graphs and tables] obtained by the authors in their studies in Montana of the inheritance of resistance to bunt (*Tilletia levis*) [*T. foetens*] and of other characters in crosses between the highly bunt-resistant Hope wheat [*R.A.M.*, xi, p. 705] and the three varieties, Marquis, Ceres, and Hard Federation, the relative reaction of which was shown to range, in the order indicated, from weak resistance to strong susceptibility. In the average $F_3$ Hope × Marquis population the tendency was towards a dominance of the stronger resistance of the Hope parent, with only 8·7 per cent. within the limits of the weak resistance of the Marquis parent; the Hope × Hard Federation cross showed a strong tendency for dominance of susceptibility, with no $F_3$ strain within the limits of the Hope parent, indicating the presence of several genetic factors. In the Hope × Ceres cross, the indications were of an intermediate inheritance, with a normal curve between the parents but with considerably less than one-fourth of the population within the limits of each parent. It is considered that these results indicate that the stronger the degree of resistance involved in the crosses the less complicated is the inheritance, with an increasing tendency away from an imperfect dominance of susceptibility towards an imperfect dominance of strong resistance.

In the Hope × Hard Federation cross, which was more closely

studied than the others, the percentage of bunted grains was about one-fourth of the percentage of bunted plants, with a negative correlation $r = -0.554 \pm 0.045$ between percentage of bunt and average yield per plant, and a positive correlation $r = 0.501 \pm 0.049$ between percentage of bunt and loss in yield. An increase of 5 per cent. in bunt caused a decrease of about 4 per cent. in yield.

No important relation was found between awnedness of the crosses on the one hand, and bunt or yield on the other.

**Prüfungsergebnisse.** [Results of tests.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xiii, 3, p. 21, 1933.

The Abavit-Beiztrommel (L. Meyer, Mainz) [*R.A.M.*, x, pp. 273, 650] is now supplied in a larger make, viz., with a diameter of about 42 cm. and a height of 50 cm. The average adherence of the dust to the seed-grain (35 kg.) after ten minutes' treatment was found to amount to 86·375 per cent. (76·67 after passage through the drill) [cf. ibid., xii, p. 430]. These figures are regarded as adequate for the purpose.

Babel (A.). **Kontimix ein neuer Kurznassbeizapparat.** [Kontimix, a new apparatus for the short disinfection process.]—*Ratschläge für Haus, Garten, Feld*, viii, 3, pp. 43–47, 3 figs., 1 diag., 1933.

Technical details are given of the new Kontimix apparatus for the treatment of seed-grain by the short disinfection process [*R.A.M.*, xii, p. 430], official tests with which at Münster, Westphalia, have resulted in a favourable verdict. It is estimated that 93 to 95 per cent. of the disinfectant is normally utilized, while an average value of 87 per cent. is reached even with very small quantities and using only one instead of two or more nozzles. Up to 22 cwt. of seed-grain may be treated per hour by the Kontimix.

Simmonds (P. M.) & Sallans (B. J.). **Further studies on amputations of Wheat roots in relation to diseases of the root system.**—*Scient. Agric.*, xiii, 7, pp. 439–448, 2 figs., 3 graphs, 1933. [French summary on p. 471.]

The purpose of the work described in this paper was to determine the effect on the wheat plant of the mechanical removal at different stages in its development of certain portions of its root system, including both the seminal roots (those originating from the seed) and the crown roots (those belonging to the crown node), with the subcrown internode intervening between the two. From the pathological standpoint, the results indicated that amputations of the seminal roots and the sectioning of the subcrown internode during the seedling stage tend to delay the development of the plant, and predispose it to attacks of certain parasitic diseases of the aerial organs, such as black rust [*Puccinia graminis*]. Injuries to the seminal roots at a later stage are believed to be of lesser importance, since it is very probable that under average conditions the activity of these roots gradually decreases without any apparent ill effects. The crown root system, because of its prolific new root formation, can withstand considerable damage under conditions favourable to the plant; if, however, it becomes

the chief absorbing system, injuries to it are likely to cause prematurity of the plant, with decrease in quantity and quality of the yield.

Applying these findings to the case of wheat root diseases caused by fungi, it is pointed out that attacks by the latter may involve both the seminal and the crown root systems, as well as the subcrown internode, resulting, in all probability, in very complex reactions, ranging from almost imperceptible symptoms to complete killing of the plant, and thus rendering a critical diagnosis of the disease very difficult.

MACHACEK (J. E.) & GREANEY (F. J.). **The effect of mechanical seed injury on the development of foot rot in cereals.**—*Canadian Journ. of Res.*, viii, 3, pp. 276–281, 2 graphs, 1933.

A tabulated account is given of the writers' greenhouse and field experiments at Winnipeg, Canada, to determine the effect of mechanical injury of Marquis and Mindum wheat, barley, and Laurel oats seed-grain on infection by *Fusarium culmorum* [*R.A.M.*, xi, p. 293]. The seed coats were injured either by puncturing the embryo end, clipping off a small portion of the 'brush' end, or scarifying with sandpaper. The greenhouse tests showed that reduced emergence and increased foot rot uniformly followed the planting of injured seed of all three cereals, and similar results were obtained in the field with wheat, Mindum being more susceptible than Marquis. The injury of the seed evidently renders the endospermic nutrients accessible to the fungus, the growth of which is thus promoted at the expense of that of the plant.

SCHAFFNIT (E.). **Beiträge zur Kenntnis der Fusskrankheiten des Getreides. (I. Mitteilung). Cercosporella herpotrichoides (Fron) als Ursache der Halmbruchkrankheit des Getreides.** [Contributions to the knowledge of the foot rots of cereals. (Note I). *Cercosporella herpotrichoides* (Fron) as the cause of the straw-breaker disease of cereals.]—*Phytopath. Zeitschr.*, v, 5, pp. 493–503, 12 figs., 1933.

Attention has already been drawn to the prevalence in Germany of recent years of the 'straw-breaking' form of parasitic lodging of cereals [*R.A.M.*, xii, p. 158]. *Fusarium nivale* [*Calonectria graminicola*], *F. culmorum*, and other well-known species of *Fusarium* are commonly isolated from diseased plants, but the inconclusive outcome of inoculation experiments with these fungi showed that they are not primarily responsible for the symptoms. *Cercosporella herpotrichoides* [ibid., xii, pp. 279, 430] was ultimately isolated from infected wheat plants and induced to form fructifications on potato stem agar. Owing to the slowness of its development, this fungus is readily overgrown in culture by the above-mentioned *Fusarium* spp. On biomalt agar the mycelium of *C. herpotrichoides* is at first bluish-grey to mouse-coloured, later turning olive and spreading out like a fan. Its septate hyphae average 2 $\mu$ in width. The hyaline, acicular conidia are mostly more or less curved (sometimes only at the apex), multiseptate (up to 5 at maturity), 10 to 105 $\mu$ in length (mean 50 to 70 $\mu$),

averaging 2 to 3 $\mu$ in width at the base and 1 to 1·5 $\mu$ at the apex; they are borne in groups of two to four on cylindrical conidiophores. Sporidia resembling the conidia in shape or cylindrical are developed in profusion on the conidia.

Three weeks after the inoculation of the leaf sheath with pure cultures of *C. herpotrichoides* just below soil level the first symptoms appeared on wheat, and a month later they became severe. At the same time winter barley was inoculated through the soil by means of infected straw, and in this case also the symptoms were noticeable after two to three weeks. The mycelium first penetrates the leaf sheath, causing the formation of pale, necrotic, brown-edged, elliptical lesions, 1 to 2·5 cm. long and $\frac{1}{4}$ to $\frac{1}{2}$ cm. wide. Similar lesions develop on the haulm within eight or ten days, while the adventitious shoots produced at a later stage are often destroyed by the fungus. The spots may occur close above the soil or up to 20 cm. along the haulm. Small, black, pseudoparenchymatous sclerotia develop on the necrotic areas and were also observed in culture. The hyphae permeate the vascular bundles, the lumen often being completely filled by the fungus. A certain correlation was detected between the prevalence of lodging and the development of the mechanical framework of the plant, the breadth of the sclerenchyma ring in the very resistant Maurener Dickkopf wheat variety being 71 $\mu$ with a cell wall thickness of 4·2 $\mu$, compared with 55 and 3·15 $\mu$ and 61 and 3·25 $\mu$, respectively, in two susceptible varieties.

*Ophiobolus graminis*, unlike *C. herpotrichoides*, is a vigorous parasite of the roots, whence it passes to the stem base. Diseased plants may be readily pulled up from the ground. This organism predominates on the lighter types of soil. In *C. herpotrichoides* the root is not attacked, but owing to the decay of the stem base the plant is liable to break on being pulled from the ground. At an advanced stage of infection the haulm cracks just above soil level, generally with a slight twist, and the plant collapses. In the case of non-parasitic lodging the affected haulms usually bend in the direction of the prevailing wind, whereas those attacked by *C. herpotrichoides* fall and become entangled at random. The length of the affected haulms is not appreciably reduced by the latter fungus, the damage consisting mainly in the diminution of yield and in the hindrance to harvesting through lodging. *C. herpotrichoides* is disseminated by conidia (the sole type of fructification so far observed) as well as through the soil. Wheat may suffer from this form of lodging on any kind of soil, but is less liable to injury on the lighter ones.

*F. culmorum* and *Calonectria graminicola* are chiefly pathogenic to seedlings, their establishment on older plants being probably secondary to necrosis or wounding of the stem base. *F. culmorum* developed actively on plants subjected to artificial lodging by the cracking of the haulms. *Cercosporella herpotrichoides* may well be one of the precursors of invasion by secondary *Fusarium* spp. The latter cause a brown discoloration of the haulm tissue up to about the third node, near which the salmon-coloured sporodochia appear.

The detection of *C. herpotrichoides* as the primary cause of cereal

lodging in Germany is not only of academic importance, but will also facilitate the study of the conditions governing infection by the parasite.

GREANEY (F. J.). **Experiments in the control of Oats rusts by sulphur dust.**—*Scient. Agric.*, xiii, 7, pp. 426–434, 1 fig., 1 graph, 1933. [French summary on p. 471.]

The results of field experiments (of the randomized Latin square type) in 1929 and 1930 at Winnipeg, Canada, showed that stem rust (*Puccinia graminis avenae*) and crown rust (*P. coronata avenae*) [*P. lolii*: *R.A.M.*, xii, p. 364] of oats were effectively controlled by applications of kolodust [ibid., xi, p. 286]. In 1929, a locally mild rust year, complete control was given by four dustings at the rate of 30 lbs. of the dust per acre, with intervals of seven days between each application. In 1930, when both rusts were severe, the best control was obtained by applications at the same rate but repeated at intervals of two days from 16th July to 22nd August: in plots so treated the yield of Victory oats was increased to 74·8 bushels per acre, as compared with 29·5 bushels in control plots.

The results [given in the form of correlation coefficients and regression equations] of the statistical study of the effect of the rusts on the yield of oats showed that the regression of yield on percentage rust was linear, indicating that uniform increases in rust infection result in uniform reductions in yield [ibid., xii, p. 426]. Under the conditions prevailing in 1930, each 10 per cent. increase in stem rust corresponded approximately to 7 per cent. reduction in yield, and crown rust was also found to be significantly correlated with yield.

On general lines, the experiments in both years are considered to indicate that the most satisfactory dusting schedules will have to be decided each year, according to weather conditions, the development of the rust, and the stage of plant growth, as well as to the measure of control already obtained by the previous dust applications.

DILLON WESTON (W. A. R.). **Sporulation of Helminthosporium avenae in artificial culture.**—*Nature*, cxxxi, 3308, p. 435, 1933.

Two Petri dishes containing potato agar were inoculated with mycelium from a non-sporing culture of *Helminthosporium avenae* [*R.A.M.*, xii, p. 163]. Three days later, the upper covers of the dishes were removed and replaced by disks of Sanalux glass, one half of which was painted over with India ink. Both cultures were then irradiated for ten minutes at a distance of 1 ft. from a Hanovia quartz mercury-vapour home model Alpine sun lamp, alternating current, 200 volts, followed by a further ten minutes' irradiation six days later. On microscopic examination of the cultures seven days after the second exposure, the mycelia on the irradiated halves were found to be strongly pigmented and to show profuse sporulation: on the non-irradiated portions pigmentation was very slight and sporulation absent. Similar experiments showed that sporulation can be induced in *H. avenae* by irradia-

tion with the light from a quartz mercury-vapour sun lamp, and by exposure in the open either to strong diffuse light or to sunlight.

Lobik (A. I.). Современное состояние вопроса о болезнях и повреждениях Кукурузы на Северном Кавказе. [Present position of the problem of the diseases and injuries affecting Maize in N. Caucasus.]—*Bull. N. Caucasian Inst. for Plant Protection*, Rostoff-on-Don, i (viii), 2, pp. 3–51, 2 pl., 1933. [English summary.]

The results of a survey started in 1929 of the diseases affecting maize in Northern Caucasus showed that the greatest damage to the crop in that region is done by dry rots of the cob caused by several species of *Fusarium* (e.g. *F. moniliforme* [*Gibberella moniliformis*: *R.A.M.*, xi, p. 778], *G. saubinetii*, and others), bacteriosis of the grain [the causal organisms of which are not indicated], and a physiological disease, characterized by the tendency of the maize grains in the cob to crack; the last-named trouble is usually associated with a white mouldy growth caused by a number of saprophytic fungi.

Laboratory and field experiments showed that, although the species of *Fusarium* causing the dry rots are carried in the seed and are present in the embryo, the disease is not transmitted to the seedlings; the viability of infected grains was found, however, to be considerably reduced. Both observations also apply to the seed infected with bacteria. There was ample evidence that the species of *Fusarium* and the bacteria are chiefly disseminated through the air, with or without the co-operation of insects, and that the chief source of infection is the maize refuse and dead plants left in the fields from one season to the next. The physiological trouble associated with white mould, on the other hand, was proved to be transmissible through the seed-grain, a fact which renders it imperative to select for sowing purposes cobs that show no signs of cracking of the grains.

The paper terminates with Russian descriptions of 47 species of parasitic and saprophytic fungi which were found to be associated with various diseases of the maize plants, among which the following may be mentioned: *Sclerospora maydis* Butl. [*S. indica*: ibid., xi, p. 546], *Leptosphaeria luctuosa* Niessl, *Mycosphaerella zeae*, *M. maydis*, *Phyllosticta zeina*, *Ascochyta zeina* [ibid., viii, p. 772], *Septoria maydis* [loc. cit.], *Oospora verticillioides* [ibid., x, p. 129], *Cephalosporium acremonium* [ibid., x, p. 644], *Nigrospora oryzae* [ibid., xi, p. 711], *Helminthosporium maydis* [ibid., x, p. 437], and *H. turcicum* [ibid., xi, p. 163]. The list also includes two species considered to be new to science, *Aposphaeria zeae* and *Colletotrichum zeae*. The former is characterized by sparsely dispersed brown pycnidia arising on a felted, dark brown mycelium covering the maize grains in the cob; the spores are elliptical or elongated, with rounded ends, hyaline, one-celled, and 4·5 to 5·7 by 3 $\mu$ in diameter. *C. zeae* developed on spots caused by *Ascochyta zeina*, forming a mycelium on which arose cylindrical, hyaline conidiophores and dark brown, septate setae; the spores were hyaline, short-clavate or oblong-ovate, and 8·4 to 18·2 by 4·9 to 5·6 $\mu$ in diameter.

The bibliography appended comprises 108 titles, almost exclusively of Russian papers.

[NATTRASS (R. M.)]. **The Diplodia rot of Citrus fruits. A possible menace to the Cyprus Citrus industry.**—*Cyprus Agric. Journ.*, xxviii, 1, pp. 24–27, 2 figs., 1933.

Since 1932 *Diplodia natalensis* [*R.A.M.*, ii, p. 543; ix, p. 777] has been observed causing gummosis and die-back of the trunks and branches of citrus trees in Cyprus, though it has not been found on the fruits either in the packing sheds or on arrival in England. The disease begins as a exudation of gum, and as it progresses large areas of bark are killed and a branch may become completely ringed, resulting in the death of the entire limb. Occasionally, the attack is confined to one side of a large branch, where it produces elongated cankers. Later, the affected tissue dries up and abundant fruit bodies are produced under the bark, which splits and peels off, leaving a powdery spore mass to be dispersed by the wind. When inoculated into fruits the fungus produced a rot closely resembling the Palestine form [ibid., xii, p. 21] and is therefore regarded as a grave potential danger to the whole citrus industry in Cyprus.

Growers are strongly urged to make a thorough search for any signs of the disease and to remove and burn systematically every affected branch.

RAYNER (M. CHEVELEY). **Mycorrhiza in the genus Citrus.**—*Nature*, cxxxi, 3307, pp. 399–400, 1933.

The writer reports the presence of the Phycomycete type of mycorrhiza in both sweet and sour oranges in the orchards of southern California [cf. *R.A.M.*, xii, p. 309], where the young roots show a regular and quite characteristic distribution of mycelium bearing large vesicles, involving inter- and intracellular infection with periodic digestion of the intracellular system of hyphae and their contents. The practical significance of this discovery lies in its application to manurial practices, the present inconsistent response to which may be correlated with the condition of the roots in regard to fungus infection.

SHARPLES (A.). **Lightning storms and their significance in relation to diseases of (1) Cocos nucifera and (2) Hevea brasiliensis.**—*Ann. of Appl. Biol.*, xx, 1, pp. 1–22, 2 pl., 3 figs., 1933.

As a result of field investigations and extensive inquiries among the local estate-owners since 1928, the author states that the cause in Malaya of the heavy annual losses in tall coco-nut palms, with symptoms which were described in a previous communication [*R.A.M.*, viii, p. 305], has been definitely traced to lightning injury and its after-effects [ibid., x, p. 160]. So far no evidence has been obtained of the presence of species of *Phytophthora* in the bud rot (termed 'false bud rot' in this paper) caused by lightning, but the possibility is not precluded that future observations may result in a species of this genus being found as a causal agent of bud rot of coco-nut palms in Malaya. It was further established that the

association of *Marasmius palmivorus* [ibid., viii, p. 305] with the disease is only secondary, this fungus simply accelerating the defoliation of the stricken palms and having nothing to do with the actual rotting of the tissues.

The investigation also showed that lightning is of some importance in the causation of disease in *Hevea* rubber plantations. In four- to twelve-month-old trees the lightning injury is usually followed by a die-back, in which the green bark turns black with the appearance at a later stage of three or four different caulicolous fungi, finally resulting in death. In such trees the losses are not important, for the young trees are seldom killed outright and rapidly regenerate when cut back to stump height. The root system is not affected. In four- or five-year-old trees slightly affected by lightning a patch of discoloured tissue was found at the collar, showing symptoms exactly similar to those of patch or claret-coloured canker, and isolations yielded a species of *Pythium* [ibid., x, p. 160], the source of which may possibly be the soil or the bark fissures of the trees.

KWASHNINA (Mme E. S.). Бактериальный гоммоз Хлопчатника на Таманском полуострове по данным наблюдений в **1931** г. [Bacterial gummosis of Cotton in the Taman peninsula, according to observations in 1931.]—*Bull. N. Caucasian Inst. for Plant Protection*, Rostoff-on-Don, i (viii), 2, pp. 52–68, 2 pl., 2 graphs, 1933. [English summary.]

This is a detailed account of a generalized bacteriosis of the cotton plant which was very prevalent in 1931 in the newly established cotton fields in the Taman peninsula [Black Sea littoral of Northern Caucasus]. The disease [which has been attributed to *Bacterium malvacearum* and some other forms: *R.A.M.*, xi, pp. 41, 316] affected the cotyledons, stems, petioles, leaves, and bolls, producing symptoms which are described and are stated to resemble closely those associated with angular leaf spot and black arm of cotton, including a severe boll and lint blight. The epidemic outbreak of the disease in 1931 is chiefly ascribed to the exceptionally wet weather which prevailed from May to September, the total rainfall for that period being 341 mm. as compared with the local normal average of 131·5 mm. From September onwards, as the weather became more settled, the incidence and severity of new infections decreased, with the result that the later pickings of the crop were considerably healthier than the earlier.

Field observations in several localities indicated the existence of varietal differences in the relative resistance to the disease of 26 varieties of American Upland cottons [*Gossypium hirsutum*] which were experimentally grown, although none of them was completely immune. In this group the varieties 1306, 2013, and 182 were the least severely attacked by the stem and boll forms of the disease, which are stated to be the most destructive under the local conditions. Varieties of *G. herbaceum*, as a class, showed considerably greater resistance, and some of them gave indications of complete immunity.

There was further evidence that sowing cotton on autumn-fallowed soil tended to reduce the incidence of early infections.

Tests with various manures showed that applications of a fertilizer containing phosphorus and potassium reduced the incidence of the disease from 83·5 per cent. in the control to 31·3 per cent., while applications of a nitrogenous fertilizer reduced the percentage of attack to 25·6. The use of relatively resistant varieties, e.g., Upland 1306, may also tend to minimize the losses.

MIHRA (R. D.). **The Khandesh Cotton breeding scheme, 1926–32.**—12 pp., 6 figs., Indian Central Cotton Ctte, Ballard Estate, Bombay, 1933.

A summary is given of the work carried on from 1926 to 1932 at the Dhulia and Jalgaon farms, with special reference to the culture, isolation, and purification of the *Gossypium neglectum* and Bani-Comilla cross, generally known as Banilla. This strain was found to show a high degree of resistance to wilt [*Fusarium vasinfectum*: *R.A.M.*, xi, p. 781], and arrangements were made for its extended cultivation. Promising results have also been obtained with *Malvensis* 40, a strain isolated from *G. neglectum*, which is wilt-resistant, gins up to 36 per cent., and has ¾ in. staple. *N. R.* 5 (roseum) [*G. neglectum* var. *rosea*] and Berar 23 also proved satisfactory in respect of wilt resistance at Jalgaon from 1930–2, but Dhulia 2 and B XXI 1 had to be discarded on account of their susceptibility to this disease.

LIDDO (S.). **La 'Blastocystis hominis' nel tubo digerente delle mosche e nell'ambiente. Ricerche sperimentali.** [*Blastocystis hominis* in the digestive tract of flies and in the atmosphere. Experimental studies.]—*Pathologica*, xxv, 496, pp. 116–118, 1933. [German and English summaries.]

*Blastocystis hominis* [*R.A.M.*, ix, p. 525] in the digestive tract of flies (*Musca domestica*) in Italy was observed to undergo regressive changes, suggesting that this situation is not a favourable one for the maintenance and growth of the organism. In faeces exposed to the air the fungus does not remain viable for more than three to four days, so that the possibilities of the transmission of the disease in an active state by flies are very restricted.

GILMAN (R. L.). **The incidence of ringworm of the feet in a university group. Control and treatment.**—*Journ. Amer. Med. Assoc.*, c, 10, pp. 715–717, 1933.

Among 500 men and 285 women students examined at Philadelphia, 60 per cent. of the former and 57 per cent. of the latter were found to be suffering from ringworm of the toes [*Trichophyton mentagrophytes* and other fungi: cf. *R.A.M.*, x, p. 243; xii, p. 291]. The most common additional involvement was tinea cruris, while infections of the hands and nails and plantar warts were of rare occurrence. The treatment of the condition is discussed.

LEGGE (R. T.), BONAR (L.), & TEMPLETON (H. J.). **Epidermomycosis at the University of California. Study III.**—*Arch. of Dermatol.*, xxvii, 1, pp. 12–24, 1933.

A study has been made of the toxicity of a number of chemicals

to three dermatophytes implicated in the causation of ringworm of the feet in California, viz., *Trichophyton interdigitale* [*T. mentagrophytes*: see preceding abstract], *T. rosaceum*, and *Epidermophyton cruris* [*E. floccosum*: *R.A.M.*, x, p. 243; xii, p. 291]. Of these organisms, the first named was shown to be consistently more resistant to the action of thymol, salicylic acid, and hexylresorcinol [ibid., x, p. 46] than the others, and further tests were therefore made on this fungus alone. The test cultures (spore suspensions) were incubated at 25° C. and the experiments carried out at 20° to 22°, the duration of exposure to the chemicals being five minutes.

Sodium thiosulphate was found to be ineffective at 10 per cent. even when the period of exposure was extended to 48 hours, an important fact in connexion with the use of this preparation for foot baths. Metaphen failed to sterilize the cultures at 1 : 500 to 1 : 5,000, while paraffin (kerosene) at full strength was also ineffectual. Hexylresorcinol proved effective at 1 : 3,000, merthiolate at all dilutions up to and including 1 in 10,000, and iodine at 1 in 100,000. Sodium hypochlorite and solution of chlorinated soda killed all the spores at the concentration (1 per cent.) recommended for foot baths, while chlorox was toxic at 1 in 5,000.

In order to test the efficacy of the new 'cold quartz light' with its short wave length of 2,500 ångströms, cultures of *T. mentagrophytes* were irradiated by this method for 1 to 15 minutes at a distance of 5 in. [ibid., xii, p. 443]. The outcome of this experiment showed that the waves possess definite fungicidal properties, though complete sterilization was not secured. The best results were given by ten minutes' exposure.

High toxicity to spore suspensions of the dermatophytes does not necessarily connote a corresponding therapeutic value on direct application to the skin, and a number of chemicals were therefore tested on skin scales infected by *T. mentagrophytes*, which were immersed in solutions of varying strength for periods up to two hours. Complete sterilization was afforded by 50 per cent. alcohol in 90 minutes, by thymol (3 per cent. in 50 or 5 per cent. in 95 per cent. alcohol) in 30 minutes, by salicylic acid (6 per cent. in 70 per cent. alcohol) and benzoic acid (5 per cent. in 95 per cent. alcohol) in 30 minutes, a new dye, crystol (resorcin crystal violet hydrochloride) in 30 minutes, 1 per cent. chlorinated soda in one hour, and iodine (1 per cent., 1 : 1,000, and 1 : 10,000) in 15 minutes.

MUSKATBLIT (E.). **Observations on Epidermophyton rubrum or Trichophyton purpureum.**—*Mycologia*, xxv, 2, pp. 109–116, 3 figs., 1933.

Two different types of cultures, one cerebriform and one downy, were isolated from each of two patients with lesions of the glabrous skin. The cerebriform type agreed in the main with *Epidermophyton* [*Trichophyton*] *rubrum*, and the downy one with *T. purpureum* [*R.A.M.*, xi, p. 44]. The latter cannot be considered as a pleomorphic degeneration of the former, since (1) it developed as a white and downy primary colony directly from planted scales; (2) it showed profuse and typical sporulation in contrast to the

sterility or scanty development of pleomorphic cultures; and (3) it underwent pleomorphic degeneration.

Two possible explanations of the phenomenon under observation are advanced. (1) The same fungus exists in at least two stable varieties, one red cerebriform, with a predominance of chlamydospores and multilocular spindle spores, this being of the type of *T. rubrum*. The other variety is white and downy, with red pigmentation of the substratum, and lateral conidia as the main form of sporulation, and is of the type of *T. purpureum*. Both varieties can be isolated in rare instances in primary plantings from the same patient. (2) The red, cerebriform and the white, downy types represent two distinct fungi (*T. rubrum* and *T. purpureum*, respectively), and may occur in the same individual as a simultaneous mixed infection with two pathogens.

CATANEI (A.). **Résultats de l'étude des teignes dans quelques agglomérations de la côte occidentale de l'Algérie et d'une nouvelle enquête en Oranie.** [The results of the study of the ringworms in some settlements on the west coast of Algeria and of a new inquiry in Oran.]—*Bull. Soc. Path. Exot.*, xxv, 7, pp. 694–699, 1932.

Continuing his researches on the incidence of the various types of ringworm affecting native, Jewish, and European children in Algeria, the writer extended his observations to certain ports and villages on the west coast and collected new data in Oran [cf. *R.A.M.*, x, p. 521]. The total cases examined numbered 3,443, of whom 2,209 were Jewish and European and the rest African natives.

*Trichophyton violaceum* was the predominant cause of ringworm among the white coastal population, followed by *T. glabrum*, *T. acuminatum*, and *T. fumatum* (formerly identified with *T. crateriforme*) [ibid., xi, p. 373]. Native children in the same regions suffered mainly from favus (*Achorion schoenleini*), ringworm when present being mostly of the smooth type associated with *T. glabrum* and *T. violaceum*, while *T. acuminatum* was prevalent in one locality. *T. violaceum* and *T. glabrum* were responsible for most of the ringworm cases at Tlemcen (Oran) in native children, the former also predominating in the Jewish colony.

CATANEI (A.). **Description de Trichophyton gourvili n. sp., agent d'une teigne de l'homme.** [Description of *Trichophyton gourvili* n. sp., the agent of a human ringworm.]—*Bull. Soc. Path. Exot.*, xxvi, 3, pp. 377–381, 1 pl., 1933.

From a ringworm of the scalp affecting native children in French West Africa, the writer isolated a species of *Trichophyton* characterized by an irregular mycelium, arthrospores, large chlamydospores, and a relatively small number of piriform aleuria, measuring on an average 5 by 3 $\mu$ but sometimes up to 6·5 by 4 $\mu$. Spindles were formed on a barley grain medium. Details are given of the cultural characters of the fungus on various nutrient media. The general aspect of the colonies is waxy, with folds, convolutions, and peripheral rays, and the colour light to dark violet according to the substratum. A pleomorphic white 'duvet'

develops on Sabouraud's glucose agar. The fungus is named *T. gourvili* n. sp.

Gougerot [H.], Burnier, & Duché [J.]. **Mycose végétante et ulcéreuse due au 'Cephalosporium griseum'.** [A spreading and ulcerous mycosis due to *Cephalosporium griseum*.]—*Bull. Soc. Franç. de Dermatol., 1933*, 3, pp. 417–418, 1933.

From a spreading ulcer succeeding to an injury with a piece of rusty iron on the leg of a male patient the writers isolated a species of *Cephalosporium* characterized by elongated or oval conidia, 24·3 by 5·4 $\mu$, aggregated into heads 27 to 30 $\mu$ in diameter [cf. *R.A.M.*, xii, p. 290]. The organism is closely related to *C. koningi* (spherical conidia 10 to 25 $\mu$ in diameter) and is named *C. griseum* n. sp. On Sabouraud's medium the fungus forms greyish, tufted colonies.

Gougerot [H.], Blum (P.), & Meyer (J.). **Pityriasis versicolor achromiant chez une négresse.** [Achromatic pityriasis versicolor in a negress.]—*Bull. Soc. Franç. de Dermatol., 1933*, 3, pp. 420–421, 1933.

*Malassezia furfur* was isolated from three types of lesions associated with achromatic pityriasis versicolor in a negress in France [cf. *R.A.M.*, ix, pp. 244 *et passim*].

Allhusen (E. L.). **Brewing and factory legislation.**—*Journ. Inst. of Brewing*, N.S., xxx, 3, pp. 98–102, 1933.

Discussing the risks to which brewery employees are exposed, the author draws attention to the prevalence among maltmen of bronchial troubles attributable in part to the occurrence in the raw barley and malt dust of *Penicillium* spores. Examination of the sputa of maltmen has shown that nearly 50 per cent. of them have spores in their bronchial tubes, often in large numbers. So far the spores have not been found actually growing in the organs, though they can be cultured from the sputum at room temperature. These spores may persist for a long time in the air passages, having been found in a man four months after he had ceased work in the maltings, and it is possible (though not proved) that under certain conditions they may directly affect the respiratory organs.

Léger (L.) & Gauthier (Mlle M.). **Endomycètes nouveaux des larves aquatiques d'insectes.** [New Endomycetes in the aquatic larvae of insects.]—*Comptes rendus Acad. des Sciences*, cxciv, 26, pp. 2262–2265, 3 figs., 1932.

An account is given of the writers' studies on a new group of fungi found parasitizing the larvae of Chironomidae in Alpine waters. The fungi occur either on the peritrophic membrane of the middle gut or in the rectal cuticle, the former being represented by two new genera of the family Harpellaceae (cf. *Comptes rendus Acad. des Sciences*, clxxxviii, p. 951, 1929), *Stachylina* and *Opuntiella*, and the latter by three new genera of the family Genistellaceae, namely, *Stipella*, *Genistella*, and *Orphella*.

*Stachylina* comprises at least two species, viz., *S. longa*, characterized by a long eccrinian tube producing, from the apex to the

base, a succession of 6 to 8 conidia 25 $\mu$ in diameter, and *S. macrospora,* the tube of which is only 100 $\mu$ long and develops into a head of 6 to 8 pedunculate conidia 40 $\mu$ in diameter. Both these species attack the larvae of *Diamesa,* the former occurring also in those of *Cricotopus, Tanytarsus,* and others.

*Opuntiella digitata*, a parasite of *Trissocladius*, consists of a simple tube ending in a short racquet-shaped conidiophore with 5 to 6 sessile, tubular conidia, 20 $\mu$ in diameter, side by side.

*Stipella vigilans* n. sp. emerges from a mucous cupule by means of a simple or forked stipe prolonged by a main axis emitting lateral branches bearing a succession of cylindrical, unilateral conidia, 70 to 80 $\mu$ in diameter. The arbuscule may attain a length of 1 mm. A biconical, curved zygospore, measuring 80 to 100 $\mu$, is inserted perpendicularly on a branch. This species is found in the rectum of Simulid larvae, often in company with *Paramaebidium.*

*G. ramosa* n. sp., a rectal parasite of *Baetis rhodani,* also associated with *Paramaebidium,* is characterized by an extensively branched thallus producing conidia 35 to 40 $\mu$ in diameter and biconical zygospores inserted obliquely on a branch. The genus, which is represented by a number of other species attacking the larvae of Ephemeridae, Nemuridae, Simulidae, Chironomidae, and Tipulidae, may be recognized by its unilateral heads of navicular conidia, resembling a tuft of broom.

*Orphella coronata* n. sp., occurring in the larvae of *Protonemura humeralis,* is affixed to the host by a broad dome-shaped structure with two radicles. The stipe attains a length of 1 mm., and the banana-shaped conidia measure 45 to 50 $\mu$. A more squat species of *Orphella* occurs in the larvae of *Nemura variegata.*

In the genera *Genistella* and *Stipella* sexual reproduction has been observed to take place by means of two cells from contiguous branches, which fuse into a large, pedunculate, thick-walled zygospore; the early phases of the process are reminiscent of those described by Thaxter for *Entomophthora sepulcralis* and suggest an affinity between the new groups of Endomycetes and the Entomophthorales [*R.A.M.*, viii, p. 502].

DRECHSLER (C.). **Morphological diversity among fungi capturing and destroying nematodes.**—*Journ. Washington Acad. Sci.*, xxiii, 3, pp. 138–141, 11 figs., 1933.

The fungus described by Zopf (*Nova Acta K. Leop.-Carol. Deutsch. Acad. Naturforsch.*, lii, p. 314, 1888) as *Arthrobotrys oligospora,* together with three other apparently closely related species, has been encountered, causing the death of immense numbers of nematodes (mostly *Rhabditis* and *Diplogaster* spp.) in agar plate cultures prepared from plantings of diseased rootlets or other decaying plant materials. A brief description is given of the morphology of the fungi under observation, all of which agreed in their manner of capturing the nematodes in one or more anastomosing hyphal loops coated on the inner surface with a transparent highly adhesive substance. One or more narrow processes then perforated the integument under the loop and swollen hyphae eventually occupied all or most of the body cavity. Three more

species of the same type but with three- or four-septate conidia instead of the bicellular ones of the first group captured their prey by a strongly adhesive disk-shaped cushion on the swollen ends of the hyphae. Several other fungi of similar habits are briefly mentioned.

HARRIS (J. J.). **Formation of 'buttons' in sweetened condensed milk by Monilia niger.**—*Zentralbl. für Bakt.*, Ab. 2, lxxxviii, 1–4, pp. 58–61, 2 figs., 1933.

*Monilia niger* [*Torula nigra* Sacc. and Trav.] was found to be responsible for the formation of small, brown, button-like clumps in sweetened condensed milk at Shelbyville, Illinois. The fungus is characterized by clusters of budding cells, 5 by 4 $\mu$ in diameter, and forms glistening, smooth, opaque, butyrous, odourless, very dark brown colonies on a plain agar slant. Acid was produced without fermentation in xylose, arabinose, dextrin, galactose, maltose, mannose, mannite, and levulose. The organism at 10,000 per c.c., when dried in a film, resisted ten minutes' exposure to 240° F. but was killed by five minutes in steam.

TIDDENS (BERBER A.). **Wortelrot van Primula obconica veroorzaakt door Thielaviopsis basicola (Berk. et Br.) Ferraris.** [Root rot of *Primula obconica* caused by *Thielaviopsis basicola* (Berk. et Br.) Ferraris.]—Thesis, University of Utrecht (Hollandia-Drukkerij, Baarn), 82 pp., 4 pl., 2 graphs, 1933. [English summary.]

*Primula obconica* plants in Dutch nurseries are stated to have been severely affected of recent years by a root rot, the first symptom of which is the development of small, black spots on the roots, later extending into a brown discoloration, sometimes accompanied by complete disintegration. The oldest leaves shrivel, while the others turn yellow, except the youngest, which is stunted and may assume a greenish-red tinge. In milder cases the older leaves show a greenish-yellow or white mottling of the leaf parenchyma [cf. *R.A.M.*, v, p. 669]; the principal veins, however, retain their normal colour.

The black spots were found to bear masses of chlamydospores of *Thielaviopsis basicola* [ibid., ix, p. 17], the mycelium and spores of which were also detected in the disintegrated root tissues. The pathogenicity of the fungus was proved by inoculation tests, which were most successful at a temperature range of 20° to 26° C. and on plants growing in culture solutions at hydrogen-ion concentrations of $P_H$ 4·8, 5·6, and 6·4; at $P_H$ 7·2 and 8 less damage was caused. In another series of experiments the reaction of the soil in which the primulas were growing was adjusted by the addition of calcium carbonate, sodium nitrate, ammonium sulphate, or sulphuric acid to 7 to 7·5, 6·8, 6·5, and 5·9 to 6·4, respectively. On inoculation with *T. basicola* the plants growing on all of these except the sodium nitrate and the control (ordinary soil), both of which had a $P_H$ value of 6·8, were severely infected, the two series at 6·8 showing only mild symptoms. Nurserymen have found that primulas grow best in a mixture of one-third each of garden

soil, leaf mould (over a year old), and well-prepared manure, peat litter, and sand. The fungus was found to be soil-borne.

In cross-inoculation experiments primula plants were more severely attacked by the strains from the same host than by that from tobacco [see above, p. 493], while a strain from poinsettia [*Euphorbia pulcherrima*] was the least virulent. Similarly, tobacco plants were more heavily infected by the tobacco strain than by that from poinsettia, while the primula strains were still less injurious. Kidney bean [*Phaseolus vulgaris*] plants suffered the greatest damage from the poinsettia strain and the least from those from primulas, the tobacco strain being intermediate in its effects. Inoculation tests on *Primula malacoides* with the two primula strains gave positive results.

Good control of *T. basicola* was given by soil disinfection with 40 per cent. formalin ($\frac{1}{2}$ l. in 6 l. water at 50°) or 0·25 per cent. uspulun at least ten days before planting.

BREMER (H.). **Zur Kräuselkrankheit der Pelargonien.** [On the curl disease of Pelargoniums.]—*Blumen- und Pflanzenbau*, xlviii, 3, pp. 32–33, 2 figs., 1933.

A popular note is given on the symptoms and conjectural etiology of the leaf curl of *Pelargonium zonatum* in Germany, together with a brief summary of Verplancke's work on this disease in Belgium [*R.A.M.*, xi, p. 649].

STAPP (C.). **Die Gelbfäule (Gelbkrankheit) der Hyazinthen.** [The yellow rot (yellow disease) of Hyacinths.]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xx, 3, pp. 309–324, 10 figs., 1933.

Among the diseases disqualifying flower bulbs from entry into Germany under an Order of 7th July, 1930, is yellow rot of hyacinths (*Pseudomonas hyacinthi*) [*R.A.M.*, x, p. 560]. Considerable dissension having arisen as to the interpretation of the Order between the Dutch bulb-exporters and German consignees, the writer investigated the disease with a view to defining some of the more important points in dispute.

It is undoubtedly possible to diagnose yellow rot on the basis of external symptoms alone, provided these are not obscured by secondary infections. The softness of the bulb under pressure is merely suspicious, conclusive proof of the disease being afforded solely by the presence of yellow to yellowish-brown 'blobs' or longitudinal discoloured stripes on the white, fleshy bulb-scales, and of yellow bacterial slime in the tracheae of the scales. It is by no means certain, moreover, that any of the rod-shaped bacteria swarming in the yellow exudate from the tracheae or vascular bundles of affected bulbs are the agents of yellow rot; they must first be subjected to examination for the presence of some important distinguishing features, e.g., the typical colony shapes (including the teratological filamentous forms with swollen centres in old bouillon cultures), the capacity for growth even in bouillon with an admixture of ethyl alcohol or chloroform, the coagulation of milk without souring, the slow liquefaction of gelatine and formation of thick, yellow layers on potato and carrot slices, and the

decomposition of various sugars without gas production. The pathogenicity of the organism should then be tested on healthy hyacinth bulbs, preferably of the susceptible L'Innocence variety.

The statements in the previous literature on yellow rot concerning the 'brown' or 'yellowish-brown' centres of the lesions appear to rest on the frequent association of fluorescent bacteria with *P. hyacinthi*; the latter by itself can only produce a yellow discoloration.

E. F. Smith's data on the morphological, cultural, and physiological characters of the yellow rot organism were confirmed and supplemented, with a few minor rectifications. The optimum temperature for the development of *P. hyacinthi* was found by the writer to extend over a slightly wider range than that fixed by Smith, i.e., 25° to 30° instead of 28° to 30° C., while the minimum should be placed at 0° rather than 4°; the thermal death point lies between 48° and 49°.

The inspection of over 3,000 hyacinth bulbs imported from Holland during 1930–1, comprising the varieties Grandeur à Merveille, General de Wet, Gigantea, Gertrude, L'Innocence, Queen of the Blues, and Queen of the Pinks, showed that the growers are well able to produce healthy material for export, especially by availing themselves of prophylactic measures of proved efficacy [ibid., x, p. 598].

TRANZSCHEL (W. A.). Ржавчина Кендыря (**Melampsora apocyni Tr.**). [Rust of Kendir fibre (*Melampsora apocyni* Tr.).]—*Plant Protection*, Leningrad, viii, 5–6, pp. 531–533, 1931. [Received June, 1933.]

The author states that the rust *Melampsora apocyni* [*R.A.M.*, xi, p. 182] is very prevalent in all the regions of Russia and Central Asia where kendir fibre [*Apocynum venetum*] has been introduced, and that its economic importance is steadily increasing. For this reason he gives a somewhat revised translation of Sydow's description of the fungus, as follows. The uredosori are hypophyllous, orange-yellow, and 0·2 to 0·4 mm. in diameter. The uredospores are globose or broadly elliptical, hyaline, densely covered with obtuse warts, and measure 17 to 22 by 16 to 18 $\mu$; paraphyses are numerous, hyaline, clavate, 35 to 42 $\mu$ long and 18 to 25 $\mu$ broad at the thickened end. The teleutosori are also hypophyllous, 0·2 to 0·5 mm. in diameter, usually coalescing in irregular groups, at first reddish-brown, later brownish-black; the teleutospores are prismatic or cylindrical-prismatic, usually rounded at the apex, light brown, and 35 to 42 by 7 to 13 $\mu$.

It is thought probable that the rust is monoecious and suggestions are made for seeking the aecidial stage on the same host in the spring. Provisionally the best means of control is considered to be the removal from the fields or the ploughing-in in the spring of all infected plant material.

MILBRATH (D. G.). **Report on a survey for Phymatotrichum omnivorum in San Diego County, California.**—*Plant Disease Reporter*, xvii, 2, pp. 15–16, 1933. [Mimeographed.]

Out of 28 lucerne fields inspected in the autumn of 1932 by

G. L. Stout at an altitude of 3,000 to 4,000 ft. in San Diego County, California, to confirm a report of the presence of *Phymatotrichum omnivorum*, 11 (all on one ranch adjoining the Mexican frontier) were found to be infected, some of them very severely. The fungus was also observed on cottonwood [*Populus deltoides*] which it had apparently destroyed. The source of infection is not known but is believed to be outside the County; possibly the cotton root rot organism may have been washed into the valley by flood waters from the mountains directly across the frontier line. The prospects of lucerne cultivation in the affected locality are considered to be very poor.

Kapshuk (A. A.). Бактериологическое изученне корневого рака плодовых деревьев. [Bacteriological study of crown gall of fruit trees.]—*Bull. N. Caucasian Inst. for Plant Protection*, Rostoff-on-Don, i (viii), 2, pp. 69–78, 1933. [English summary.]

After a brief reference to the rapidly increasing economic importance of crown gall (*Bacterium tumefaciens*) of fruit trees in Northern Caucasus [*R.A.M.*, x, p. 603], the author gives details of his bacteriological studies of several isolations of the organism from various hosts and from the soil in infected orchards, the results of which showed their entire identity in morphological and cultural characters. All the isolations tested were shown to be equally virulent to beet, tobacco, and tomato; in one experiment, in which healthy tomato seed was watered after sowing with a suspension of *Bact. tumefaciens*, at first the seedlings emerged normally, but a week after emergence some of the seedlings began to die off, with distinct microscopical galls at the base of their stems. The surviving seedlings were dug out a month later, when 20 per cent. of their number bore well-formed galls at the crown, some attaining the size of a pea; swellings on the rootlets without the formation of definite galls were also found. It is thought probable that infection of the seedlings took place before their stems became lignified, or perhaps even earlier, at the time when the embryos began to break through the seed coats.

While it was experimentally shown that mercuric chloride, copper sulphate, and chloride of lime are useless for the disinfection of soil naturally or artificially infected with *Bact. tumefaciens*, preliminary tests in which infected soil was subjected in hermetically sealed containers to the action of chlorpicrin, showed that at the dose of 10 c.c. of chlorpicrin to 1 c.m. of the enclosed space, the substance penetrated to a depth of 20 cm. in the soil and effectively killed the bacteria in it. Cultures of the organism were killed after one hour's sojourn in an atmosphere containing over 6 c.c. chlorpicrin per c.m.

Pickett (W. F.) & Filinger (G. A.). **Spraying fruit plants.**—*Kansas Agric. Exper. Stat. Circ.* 169, 34 pp., 20 figs., 1932. [Received May, 1933.]

In this paper (a revision of *Circular* 145) directions are given in popular terms for the treatment of some well-known diseases and pests of fruit trees by spraying with standard preparations. The

symptoms of the diseases are briefly described, with notes on varietal susceptibility and other points of interest.

CSORBA (Z.). **Untersuchungen über die Ursachen der Empfänglichkeit und Widerstandsfähigkeit der Apfelsorten gegen den Apfelmehltau.** [Investigations on the causes of the susceptibility and resistance of Apple varieties to Apple mildew.]—*Mezögazdasági-Kutatások*, Budapest, v, pp. 326–339, 1932. [Abs. in *Chem. Zentralbl.*, civ, 19, p. 2962, 1933.]

Investigations at the Budapest Institute for Plant Diseases showed that the outer wall of the epidermal cells is thinner (average 2·13 $\mu$) in apple varieties susceptible to mildew (*Podosphaera leucotricha*: see next abstract] than in resistant ones (2·67 $\mu$).

JANCKE (O.). **Ueber den Einfluss der Kalidüngung auf die Anfälligkeit der Apfelbäume gegen Blutlaus, Blattlaus und Mehltau.** [On the influence of potash fertilizing on the susceptibility of Apple trees to the woolly aphis, green Apple aphid, and mildew.]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xx, 3, pp. 291–302, 1 plan, 1933.

Contrary to the results of Schaffnit's and Volk's experiments on the effects of nutrition on the reaction of various plants to fungous parasites [*R.A.M.*, ix, p. 473], the writer obtained no improvement in the condition of apples suffering from mildew (*Podosphaera leucotricha*) [ibid., xii, p. 298] by the application of potash, which was applied as potassium nitrate and potassium chloride at the rate of 1 and 0·8 gm., respectively, per l. of nutrient solution.

BARTHELET (J.). **Le blotch fumeux des Pommes.** [Sooty blotch of Apples.]—*Bull. Soc. Nat. Hort. de France*, Sér. 5, vi, 3, pp. 149–150, 1 fig., 1933.

Sooty blotch (*Gloeodes pomigena*) [see above, p. 488] is stated to be of frequent occurrence on Reinette [Pippin] Clochard, Frémy, and Grand'mère apples in Charentes, Deux-Sèvres, and other parts of France where orchards have been planted on damp sites. The marketable value of the fruit is much reduced by the lesions; these may be removed by means of a decolorizer which gives the skin the appearance of a grey Canadian pippin, but this is a tedious operation in the course of which the apples are very liable to injury. Good control may be obtained by the application of a copper fungicide, supplemented if necessary by a summer treatment with lime-sulphur. [An account of this work also appears in *Rev. Path. Vég. et Ent. Agric.*, xx, 3, pp. 135–138, 1 pl., 1933.]

HUBER (G. A.). **Aspergillus sclerotiorum, n. sp., and its relation to decay of Apples.**—*Phytopath.*, xxiii, 3, pp. 306–308, 1 fig., 1933.

From 1926 to 1929 eleven forms of *Aspergillus* were isolated from the surface of normal apples in Washington, and since the latter year a further three have been investigated from the same source [*R.A.M.*, x, p. 398; xi, p. 378]. Only one of the forms recently examined proved pathogenic on Jonathan apples, causing decay both at common and cold storage temperatures. It belongs

to the *A. ochraceus* group, *sulphureus* series, of Thom and Church [ibid., v, p. 700], and is named *A. sclerotiorum* n. sp., with a diagnosis in English.

On Czapek's solution agar the fungus forms sulphur-yellow (Ridgway) colonies, reaching a diameter of 35 mm. in ten days at 25° C. Loose, hemispherical to columnar conidial heads are formed, commonly splitting into two or more divergent columns, the hermispherical measuring up to 140 $\mu$ in width and the columnar up to 250 by 140 $\mu$; they are borne on pale yellow, pitted stalks, up to 1,200 by 6 to 12 $\mu$, widening slightly towards the head. The globose to flask-shaped vesicles measure up to 40 $\mu$ in diameter, and the primary and secondary sterigmata up to 8·5 $\mu$ in length. The conidia are globose, smooth, 2 to 3 $\mu$ in diameter, with slightly yellow-tinged walls. Subglobose to globose, white, later flesh-pink sclerotia, up to 1·5 mm. in diameter, begin to appear on three-day-old cultures and subsequently develop in profusion.

On inoculation into sound, ripe apples, the fungus produced lesions measuring 42 to 46 mm. in diameter after 42 days at 22° to 25°, the corresponding measurement at 4° to 6° being 16 to 23 mm. After 90 days at the latter temperature the lesions had reached a diameter of 28 to 38 mm., while at 0°–2° the diseased areas measured 10 to 14 mm. after 120 days. The lesions were slightly sunken and showed a tendency to concentric ring formation. The decayed tissue was dark tan, dry, and spongy.

KUNKEL (L. O.). **Insect transmission of Peach yellows.**—*Contrib. Boyce Thompson Inst.*, v, 1, pp. 19–28, 3 figs., 1933.

In this paper the author reports the first successful insect transmission of peach yellows [*R.A.M.*, xi, p. 521], the leafhopper *Macropsis trimaculata* (Fitch) alone out of a number of insects tested transferring the disease to 7 out of 74 healthy seedling peaches after feeding on diseased ones.

*M. trimaculata*, reported on plums in New York and other States and on peaches in Virginia, was numerous on both peach and plum trees in the vicinity of New York City in the summers of 1931 and 1932. Both nymphs and adults feed on twigs, large branches, and occasionally on leaves. They prefer old branches and trees to young ones, a fact which may account for the small percentage of successful transmissions of yellows to young peach plants. They produce only one generation a year, and transmission tests are possible only during the relatively short periods when the young broods are feeding.

In the author's experiment nymphs and adults were transferred from healthy and 'yellowed' orchard trees to insect-proof cages containing yellowed peach seedlings in pots. After remaining on the diseased seedlings for 2 to 21 days the insects were transferred to healthy seedlings in other cages, colonies of 2 to 100 individuals being allowed to feed for various periods between 3rd June and 7th August, 1931, on the healthy seedlings immediately upon removal from the yellowed ones. After exposure to the insects, all the seedlings were kept in a greenhouse free from sucking insects, and were then placed outside on 15th September in uncovered cold frames with control trees and trees exposed to

another insect, to become hardened before going into the dormant condition. All the trees were finally transferred to a greenhouse about 1st December. The seven trees which took yellows were exposed to the infective insects in July. Evidence was obtained which suggested that there may be a long incubation period for the virus in the insect.

One tree which took the disease was exposed for only two days, another for six, and the remainder for longer periods. Four trees showed well-marked symptoms 78, 86, 94, and 173 days, respectively, after exposure, the remaining three showing the symptoms after 186 days.

In the three trees which first showed signs of yellows the symptoms appeared as they began to lose their leaves; instead of becoming fully dormant as the weather grew cold, some of the branches continued to grow, producing characteristic, tender secondary shoots. All the other trees exposed to *M. trimaculata* as well as the control trees lost their leaves. As the trees began to grow when removed from the cold frames to the greenhouse the three that had shown yellows when in the frames and four others of those exposed to *M. trimaculata* became badly yellowed, though 133 control peach trees and 60 peach trees exposed to another insect were still healthy one year later.

GRUBER (F.). **Beerenobstzüchtung.** [Berry fruit breeding.]—*Der Züchter*, iv, p. 237, 1932. [Abs. in *Fortschr. der Landw.*, viii, 11, p. 258, 1933.]

The first attempts to carry out a systematic programme of berry fruit breeding in Germany are stated to have been initiated at the Kaiser Wilhelm Institute for Breeding Research, Müncheberg, Mark Brandenburg, where experiments are in progress in the selection of raspberries resistant to *Didymella applanata*, currants to *Gloeosporium* [*Pseudopeziza*] *ribis*, and gooseberries to American mildew (*Sphaerotheca mors-uvae*). In connexion with the last-named disease promising results have already been obtained.

HARRIS (R. V.). **The Strawberry 'yellow-edge' disease.**—*Journ. Pomol. and Hort. Science*, xi, 1, pp. 56–76, 4 pl., 2 figs., 1933.

An account is given of experiments in 1931 and 1932 at the East Malling Research Station, Kent, the results of which showed that a disease of the Royal Sovereign strawberry first seen in 1930 and suspected to be of the virus type, is transmissible by grafting [by a method which was described in an earlier publication: *Journ. Pomol. and Hort. Science*, x, 1, pp. 35–41, 1932], and is independent of mite (*Tarsonemus fragariae*) and insect infestation or other external causal factors.

One of the most marked features of the disease is that during the two years in which it has been under close observation, the diagnostic leaf symptoms were completely manifested only from the middle of September until the end of October; although individual plants showed symptoms before and after this critical period, the freedom or otherwise of a given plant from infection could not be established even tentatively until this period was reached. In this respect, as well as in other symptoms, this

disease (for which the descriptive name 'yellow edge' is suggested) closely resembles the American strawberry xanthosis [*R.A.M.*, vii, p. 650]. During the critical period, the general appearance of the 'yellow edge' plants is very characteristic, the plant being abnormally flattened and consisting of a zone of more or less normal outer leaves surrounding a central zone of diseased young leaves. The latter exhibit a chlorosis or yellowing confined to the marginal areas, invariably accompanied by a general dwarfiness, an irregular curling (mainly upwards) of the margins, a downward curling of the midrib, and a twisting of the whole lamina. The petiole is abnormally short, stout, and lacking in red pigmentation. The intensity of these symptoms varies with the stage of attack reached, and ranges from very slight stunting, distortion, and discoloration, to the production, in advanced cases, of a tight rosette of extremely dwarfed, distorted, and chlorotic leaves entirely lacking in red pigmentation. The outer zone of leaves in naturally or artificially infected plants was observed to develop the autumn red colour earlier than healthy plants.

Analogous symptoms were also seen on eleven other varieties of strawberry, in particular on Stirlingworth and Stirling Castle, and the fact that when a diseased plant of the last-named variety was grafted on a healthy Royal Sovereign plant the latter became typically diseased is considered to indicate the identity of the infective principle concerned. There was clear evidence that the varieties differed in their relative susceptibility; there was a further suggestion that strains of a single variety may also differ in this respect, and further work is in progress to test this point, and also to determine the possible vectors of the disease, with special reference to the Tarsonemid mite which has been found on yellow edge plants with remarkable constancy.

The paper terminates with a brief consideration of possible control measures, among which elimination by roguing is thought to be the most promising, since field observations showed that the virus can pass from an infected plant into all of its vegetative progeny during the course of a single season.

CARTER (W.). **The Pineapple mealy bug, Pseudococcus brevipes, and wilt of Pineapples.**—*Phytopath.*, xxiii, 3, pp. 207–242, 9 figs., 2 diags., 1 graph, 1933.

A comprehensive account is given of the writer's investigations on pineapple wilt in Hawaii, the results of which confirmed J. F. Illingworth's evidence as to the transmission of the disease by mealy bugs (*Pseudococcus brevipes*) following their feeding on infected plants [*R.A.M.*, xi, p. 191 and next abstract]. Two main types of wilt are differentiated, namely, quick and slow, the former (from which recovery is common) occurring chiefly on young plants after a short period of feeding by a fairly large insect colony, and the latter resulting from the development of the mealy bugs for a considerable time on the leaves. The colour changes associated with quick wilt are very striking, ranging from yellow or yellowish-brown to bright pink or red, while plants affected by the slow type show a number of green or chlorotic spots—the old feeding-points of the insects, and a brown discoloration, shrivelling, and drooping

of the outer leaf tips, frequently accompanied by secondary necrosis. The actual cause of the disturbances in question seems to be a non-living toxic insect secretion of variable diffusibility.

CARTER (W.). **The spotting of Pineapple leaves caused by Pseudococcus brevipes, the Pineapple mealy bug.**—*Phytopath.*, xxiii, 3, pp. 243–259, 3 figs., 2 diag., 1933.

Two general types of spotting of pineapple leaves are associated with invasion by *Pseudococcus brevipes* [see preceding abstract], one being the chlorosis characteristic of coccid feeding generally, while the other assumes the form of a green spotting of very erratic occurrence. Thus, colonies of mealy bugs have been maintained for long periods without any development of green spot; for similar periods with the constant formation of green spots; or green spots may be produced at intervals. Mealy bugs from non-green-spotting colonies failed to produce these lesions even after feeding on green-spotted tissue. The capacity to form green spots was found to be transmissible from the mother to a part of her progeny and to be limited to certain individuals within a colony. Based on a preliminary study, the working hypothesis has been evolved that the insect's secretions are conditioned by the activities of the associated mycetome and its two types of included symbionts [details of which are given: cf. *R.A.M.*, v, p. 31; vii, p. 512].

SERRANO (F. B.) & PALO (M. A.). **Blossom-blight of Mangos in the Philippines.**—*Philipp. Journ. of Sci.*, l, 3, pp. 211–277, 17 pl. (1 col.), 1933.

In connexion with a study of blossom blight of the mango, caused by two leafhoppers, *Idiocerus clypealis* and *I. niveosparsus*, in the Philippines, the writers give a short note on anthracnose (*Glomerella cingulata*) [*R.A.M.*, ix, p. 230] which is generally of minor importance but may be responsible for heavy damage in seasons marked by several days' continuous rainfall during the flowering period (normally January to April). Late flowering trees were severely attacked towards the end of May, 1932, as a sequel to a week's successive rain from the 12th onwards. Both the flowers and young fruits are destroyed by the fungus.

PAOLETTI (V.). **Osservazioni ed esperimenti orientativi di lotta contro la rogna dell'Olivo.** [Tentative observations and experiments for the control of Olive knot disease.]—*Riv. Pat. Veg.*, xxiii, 1–2, pp. 47–50, 1933.

An investigation into the olive knot disease (*Bacterium* [*Pseudomonas*] *savastanoi*) [*R.A.M.*, vii, p. 725; viii, p. 547], which during the last ten years has become increasingly prevalent in certain parts of Italy, showed that the most resistant trees are those with the toughest bark which does not readily crack or become injured by meteorological conditions. Two or three months after long cuts had been made in the bark of affected trees, new tumours were invariably present in the lesions, indicating bacterial entry through such wounds. The spread of the disease is strongly favoured by rain.

The pruning of badly knotted trees facilitates ingress of the

bacteria and generally weakens the condition of the trees. Applications of stable manure produce soft tissues, with the result that the bark is less able to resist traumatic injury. On the other hand, spraying with Bordeaux mixture, by protecting the leaves against *Cycloconium* [*oleaginum*: ibid., x, p. 130], markedly improves the condition of affected trees as a whole.

On badly affected trees the tumours arise where the rain collects on the bark or where it runs down along the trunk. The serious destruction of bark on young olives is due to rain water containing the bacteria collecting in the long cracks caused in the trunk by traumatism or increase of girth.

Two years' tests clearly demonstrated that effective control [cf. ibid., v, p. 679] is given by making four applications per year to the entire tree of Bordeaux mixture containing 1 to 2 per cent. copper sulphate, the first application being made at the end of December, just after picking (as a protective covering to the injuries incidental to the harvesting), the second at the end of February (to protect against the results of hail injuries), the third at the onset of the spring rains, i.e., 1st to 10th April, and the fourth before the autumn rains set in, i.e., 1st to 15th September. An annual application of 2 to 4 kg. mineral superphosphate should be given to each affected tree in the place of stable manure, and pruning should be discontinued for at least two years in succession. Trees so treated recover, form a luxuriant, dark green foliage and give an abundant yield ; the old excrescences dry up, and it is very seldom that any new ones form.

BRITON-JONES (H. R.). **Preliminary trials with a combined insecticide and fungicide.**—*Trop. Agriculture*, x, 3, pp. 80–84, 1933.

A brief account is given of the author's tests of a cheap [mineral] oil product prepared by a Trinidad oil company, the results of which showed this substance to be of value in the control of the cacao witches' broom disease [*Marasmius perniciosus*: *R.A.M.*, xii, p. 207], since it readily killed the delicate growing points of the host, thus reducing the liability to infection [ibid., x, p. 658]. Further experiments indicated that at concentrations non-injurious to plant growth, the substance very effectively killed various types of noxious insects, and gave promise of being also effective against fungi, although it did not appear to be protective against new infections. It was found, however, to be a true solvent of sulphur which, on dilution of the solution with water and exposure to the atmosphere, is converted by oxidation into colloidal sulphur, the fungicidal and protective properties of which are well known. This sulphur-oil compound is marketed under the name 'sulphemulsol' at the price of 30 cents. (1s. 3*d.*) per gall. f.o.b. Trinidad in non-returnable drums, and preliminary trials showed that at the strength of 3 per cent. it effectively controlled various types of insect pests on several varieties of citrus trees without injury to the trees in fruit, although trees in blossom were somewhat injured. The indications were also that the compound will control fungous diseases amenable to treatment by spraying, and it is thought probable that spraying citrus trees in the grove may tend to keep

down storage rots, owing to the (invisible) deposit on the sprayed fruit of colloidal sulphur. Laboratory tests showed that when cacao pods artificially infected with the black pod fungus (*Phytophthora palmivora*) [ibid., xii, p. 207] were sprayed with, or dipped in, a 2 per cent. solution of sulphemulsol, the fungus on the pods was effectively killed, the results comparing favourably with those obtained with 2 per cent. Burgundy mixture. Finally, steeping sugar-cane cuttings in 5 per cent. sulphemulsol for ten minutes or for 30 minutes in a 2 per cent. solution, did not affect the germinability of the setts. The fungicidal efficacy of the compound on a field scale has not yet been tested, though Petri dish and other laboratory tests have all given good results.

JANKE (A.) & BERAN (F.). **Über die mikrobicide Wirkung von organischen Säuren und ihren Kupfersalzen. Ein Beitrag zum Problem des Zusammenhangs zwischen chemischer Konstitution und mikrobicider Wirkung.** [On the microbicidal action of organic acids and their copper salts. A contribution to the problem of the connexion between chemical constitution and microbicidal action.]—*Arch. für Mikrobiol.*, iv, 1, pp. 54–71, 1933.

At the Vienna Plant Protection Institute fourteen copper salts of organic acids, ten corresponding free acids and inorganic copper salts (sulphate and chloride), cadmium acetate, and bismuth salicylate were tested at varying concentrations for their action on a number of bacteria and two fungi, *Trichothecium roseum* and *Sclerotinia cinerea*.

The results [which are tabulated and discussed] showed that *T. roseum* was killed by 10 minutes' exposure to formic acid ($P_H$ 5, $\frac{1}{2}$ mol., $\frac{1}{2}$ equivalent per l.) and by the same compound, unbuffered (2 mol., 2 equiv.) in 5 minutes; acetic acid ($P_H$ 5, 4 mol., 4 equiv.) killed the same fungus in 5 minutes, as also did benzoic acid ($\frac{1}{20}$ mol., $\frac{1}{20}$ equiv.), salicylic acid ($\frac{1}{50}$ mol., $\frac{1}{50}$ equiv.), phenol ($\frac{1}{2}$ mol., $\frac{1}{2}$ equiv.), and copper salicylate ($\frac{1}{10}$ mol., $\frac{1}{5}$ equiv.). *T. roseum* was not injured by exposure to copper sulphate (2 mol., 4 equiv.) for periods up to 360 minutes, and succumbed to copper chloride (4 mol., 8 equiv.) only after 180 minutes.

*S. cinerea* was killed in 5 minutes by formic acid ($P_H$ 5, $\frac{1}{2}$ mol., $\frac{1}{2}$ equiv.), in 30 minutes by acetic acid (2 mol., 2 equiv.), in 5 minutes by butyric acid (1 mol., 1 equiv.) and phenol ($\frac{1}{2}$ mol., $\frac{1}{2}$ equiv.), and in 10 minutes by copper salicylate ($\frac{1}{10}$ mol., $\frac{1}{5}$ equiv.). The growth of this fungus on removal from the solution was not impaired by exposure to copper sulphate (2 mol., 4 equiv.) for periods up to 360 minutes, while copper chloride (4 mol., 8 equiv.) exercised an inhibitory effect only after 180 minutes.

VELTHORST (H.). **Die konservierende Wirkung einiger Paraoxybenzoësäure-Ester.** [The preservative action of certain para-oxybenzoic acid esters.]—*Pharmazeut. Monatshefte,* xiii, 9, pp. 199-202, 1932.

The results [which are summarized and tabulated] of a series of tests at Utrecht University on the preservative action on foodstuffs of the para-oxybenzoic acid esters (on the market under the names

of nipasol and nipagin) [*R.A.M.*, xi, p. 466] indicate that the effects of these preparations are too uncertain and irregular to warrant their general recommendation in place of benzoic acid. In some cases mould and bacterial growth was entirely suppressed, while in others the disinfectant action was quite insufficient. Under Dutch law the use of benzoic acid is permitted for certain purposes in food preservation.

READ (W. H.) & ORCHARD (O. B.). **Plant injury following the burning of sulphur in vacant glasshouses.**—*Journ. Min. Agric.*, xxxix, 12, pp. 1085–1087, 1933.

Chrysanthemums grown in 1932 at the Experimental and Research Station, Cheshunt, were observed a few days after their removal into glasshouses, that had been disinfected by burning sulphur, to develop a severe scorch of their foliage, stems, growing tips, and buds, occasionally resulting in the complete loss of the flowers. The injury was traced to drippings from overhead galvanized wires and surfaces covered with a paint containing zinc oxide. Such drippings, caused by the condensation of moisture in the glasshouses, especially after damp or foggy nights, were found to contain high concentrations of zinc sulphate resulting from the oxidation in a damp atmosphere of the sulphite formed by the action of the sulphur dioxide produced during disinfection on the zinc-containing surfaces, and a similar type of injury was experimentally reproduced by splashing chrysanthemum plants with solutions of zinc sulphate at concentrations over 0·33 per cent.

The trouble may be greatly minimized by thoroughly hosing down the painted surfaces with water at frequent intervals when the glasshouses are wet, or by maintaining a dry atmosphere in the latter. The use of paint with a lead or barium base would also be a means of counteracting the trouble, another alternative being the use of naphthalene or formaldehyde instead of burning sulphur for the disinfection of the glasshouses. Sulphur dusting was shown to have no detrimental action in the glasshouses where zinc paints were used.

STANER (P.). **La phytopathologie au Congo belge.** [Phytopathology in the Belgian Congo.]—*Rev. des Questions Scient.*, *20 Nov., 1932*, pp. 437–452, 1932.

The greater part of this paper is an historical outline of the development of the phytopathological service in the Belgian Congo since its inception in 1910, including the description, year by year, of the work done in the study of the chief fungal diseases and insect pests which attack economically important crops in that colony.

HASELHOFF (E.), BREDEMANN (G.), & HASELHOFF (W.). **Entstehung, Erkennung und Beurteilung von Rauchschäden.** [The origin, recognition, and assessment of smoke injuries.]—xii + 472 pp., 36 figs., Berlin, Gebr. Borntraeger, 1932. [Abs. in *Fortschr. der Landw.*, viii, 11, pp. 259, 1933.]

This is stated to be a comprehensive survey of the results of research on the effects of smoke gases on plant growth [*R.A.M.*, v, pp. 67, 396; vii, p. 352 *et passim*]. The aspects of the problem

discussed include the origin and composition of smoke from factories and the like, the external characters and extent of smoke injury, and the detection of gases in the atmosphere. A special section is devoted to chemical and botanical investigations of the injuries caused by the various gases and emanations. The legal side of the smoke injury question is also fully considered.

TAKAHASHI (W. N.) & RAWLINS (T. E.). **Stream double refraction exhibited by juice from both healthy and mosaic Tobacco plants.**—*Science*, N.S., lxxvii, 1994, p. 284, 1933.

In previous experiments the writers found that the juice from frozen, healthy tobacco leaves failed to show the stream double refraction characteristic of that from similarly treated mosaic foliage [*R.A.M.*, xii, p. 401]. In recent tests, however, the juice from unfrozen healthy leaves exhibited marked stream double refraction. The phenomenon was not manifested by juice from unfrozen healthy tobacco leaves subjected to treatment with safranin [ibid., xii, p. 332]. These data apparently indicate that all the detectable double refractive material was removed from the healthy juice, but not from the infective, by the purification process, and suggest that much or all of the doubly refractive material in the diseased plant juice may be different from that in the healthy. It cannot, however, yet be definitely asserted that the virus particles are responsible for all or part of the double refraction shown by diseased plant juice.

SHEFFIELD (F[RANCES] M. L.). **The development of assimilatory tissue in Solanaceous hosts infected with aucuba mosaic of Tomato.**—*Ann. of Appl. Biol.*, xx, 1, pp. 57–69, 3 pl., 1933.

Continuing her investigations of the aucuba mosaic of tomato [*R.A.M.*, xi, p. 335 and next abstract], the author gives details of her comparative study of the development of the chloroplasts in normal tomato, tobacco, and *Solanum nodiflorum* plants, on the one hand, and in the same hosts after infection with aucuba mosaic, on the other. In normal plants the origin of the plastids was traced back to certain minute, slightly elongated granular bodies which are present in the young cells of the primary meristem of the shoots, and which cannot be differentiated from chondriosomes either by their shape or by their chemical reactions. After cell division in the meristematic tissue has ceased, these bodies begin to enlarge; a vacuole is formed in each, and grows bigger as the protoplastid increases in size; a starch grain (occasionally two or three) is formed in the vacuole. The outer stroma of the protoplastid then becomes pigmented and numerous pores are formed in it. The chloroplasts were seen sometimes to divide.

In plants infected with aucuba mosaic, certain of the leaf tissues were seen to be devoid of plastids, their absence being caused by an inhibitory effect of the virus on the development of the primordia, which are usually destroyed in a very early stage; failing this, perfectly normal plastids are formed in the diseased tissues. While mature plastids were never observed to be affected by the virus, intermediate stages may be so affected. The cells of the affected leaf tissues may be undifferentiated.

Although intracellular inclusions [loc. cit.] do not occur in the meristematic tissue, incipient bodies were seen in cells which were increasing in size and after the development of plastids was well advanced. This would explain the indiscriminate formation of intracellular inclusions in green and chlorotic areas on the presumption that the virus in such cases reaches the green tissue too late to inhibit the development of the plastids. No definite evidence was obtained to show whether the prevalence of the inclusions in tegumentary tissues and their rarity in assimilatory tissue is due to differences in the $P_H$ of these tissues.

SHEFFIELD (F[RANCES] M. L.). **Virus diseases and intracellular inclusions in plants.**—*Nature*, cxxxi, 3305, pp. 325–326, 1 fig., 1933.

An investigation was conducted at Rothamsted Experimental Station to determine whether reactions in certain Solanaceae similar to those induced by inoculation with aucuba mosaic of tomato [see preceding abstract] could be stimulated by physico-chemical means.

Healthy tomato, *Solanum nigrum*, and *S. nodiflorum* plants were treated with small doses of chemical substances known to cause protoplasmic coagulation, viz., mineral acids and salts and organic compounds such as acids, alcohols, and alkaloids. Each of the reagents produced, in a greater or lesser degree, symptoms recalling the first microscopic evidence of virus infection; the cytoplasm became increasingly conspicuous and its streaming was accelerated. Hyaline spheres, resembling the bodies accompanying certain virus diseases, were also formed in some cases but failed to persist for any length of time. Molybdenum, given in the form of molybdic acid or its ammonium or sodium salts, induced in the cells processes analogous to all stages of an attack of aucuba mosaic. Soon after treatment began, the cytoplasm appeared to increase in volume and stream more rapidly; minute, yellowish particles were carried about the cell and coalesced when brought together by the flowing of the plasm, until by successive fusions a single large mass was gradually built up. In its final stage the body was rougher in outline and slightly more granular than those produced by aucuba mosaic, which it resembled, however, in all essentials. None of the other radicles produced effects so closely simulating those of aucuba mosaic.

SAMUEL (G.) & BALD (J. G.). **On the use of the primary lesions in quantitative work with two plant viruses.**—*Ann. of Appl. Biol.*, xx, 1, pp. 70–99, 1 pl., 1 diag., 5 graphs, 1933.

In this paper the authors describe in some detail their attempts to apply Holmes's method [*R.A.M.*, viii, p. 138; xi, p. 333 *et passim*] to the quantitative study by means of local lesions of the viruses of tobacco mosaic 1 (obtained from J. Johnson) and of spotted wilt of tomato [ibid., xii, p. 59]. The experiments [the results of which were checked by statistical methods] were made on *Nicotiana glutinosa* plants for the tobacco mosaic, and on tobacco plants (Blue Pryor mainly, but White Burley is stated to be as good for this purpose) for tomato spotted wilt. In the

course of the work they evolved the following standardized method, which they used in their later quantitative studies. Good batches of the experimental plants were raised from seed obtained from a single self-fertilized plant (tobacco or *N. glutinosa*), the seedlings being grown under the best conditions, and all being treated alike as regards transplanting and watering with soluble fertilizers. A few days before being used for an experiment, the plants were sorted out into the groups required by taking first the largest and putting one in each group, then the next largest, and so on until the groups were complete and as even as possible to the eye. The *N. glutinosa* plants were trimmed down to five leaves, and kept three to five days before inoculation. The latter was done with an elongated ground-glass spatula, the flattened end of which was about $1\frac{1}{4}$ inch long to fit comfortably across half the leaf blade of *N. glutinosa*. The spatula was dipped into the virus so as to lift plenty of liquid to cover the half-leaf, and was drawn gently but firmly over the half-leaf from stem end to tip, the leaf being supported on the hand covered with a fresh square of newspaper; a single rub was found to be sufficient. If the virus tested was more concentrated than 1 in 10, after inoculation of the five half-leaves on a plant, the excess virus was immediately washed off with sterilized water, care being taken not to wet the opposite half-leaves, which were inoculated with the other virus under test (the tests were mainly different dilutions of the same virus or comparisons of the strengths of the same virus from different sources) after the whole group of five or ten plants had been inoculated with the first virus. In the case of spotted wilt inoculations on tobacco, owing to the larger size of the leaves, the spatula was usually drawn down at the same angle as the lateral veins, once over each interveinal space until the whole leaf was covered. When the inoculations had to be made quickly, however, the cheese-muslin method was used. Counts of the localized lesions were made 6 to 8 days after inoculation.

The paper terminates with a brief description of the results obtained by this method in the study of the virus concentrations obtained from different sources, the content in virus of necrotic primary lesions as compared with non-necrotic ones, the increase of spotted wilt virus in the tops of infected tomato seedlings, and of the effect of physical and chemical agents on the viruses.

CALDWELL (J.). **The physiology of virus diseases in plants. IV. The nature of the virus agent of aucuba or yellow mosaic of Tomato.**—*Ann. of Appl. Biol.*, xx, 1, pp. 100–116, 1 graph, 1933.

Continuing his studies of the virus of the aucuba mosaic of tomato [*R.A.M.*, xi, p. 754], the author gives details of experiments in which he inoculated *Nicotiana glutinosa* plants with various dilutions of the virus by rubbing the surface of the leaves with the tip of the index finger dipped in the inoculum, an attempt being made to break the hairs on the adaxial side without, so far as possible, damaging the mesophyll tissues. The infectious material was prepared by adding 2 c.c. of water to 1 gm. of pulp from crushed aucuba mosaic tomato or tobacco leaves, left standing

for 24 hours, filtered through fuller's earth, and then used as stock material, from which dilutions were prepared. In preliminary tests, high concentrations of the virus were shown not to be suitable for quantitative work [see preceding abstract], since some factor, possibly the number of hairs broken, limited the number of local lesions produced; it was shown, however, that dilutions of about 1 in 50 and higher were quite satisfactory, though even at these dilutions there was considerable individual variation and it was not possible accurately to foretell the strength of the inoculum tested from the intensity of the symptoms on the plant from which it was derived.

The results of the experiments [some of which are presented in the form of tables] indicated that with the higher dilutions the number of spots formed is directly proportional to the amount of dilution, this offering a strong presumptive evidence of the particulate nature of the virus, and suggesting that each particle or group of particles is able to induce the appearance of a necrotic spot. No evidence was obtained to show that shaking of the virus inoculum increased the number of the particles present in it, after the juice tested had been freed by filtration from cell débris, nor did the addition of proteolytic enzymes to the inoculum increase their number.

The paper also includes a brief outline of a method which is believed to be capable of giving an approximate idea of the number of virus particles present in any given virus; it terminates with a brief description of experiments which showed that the multiplication of the aucuba mosaic virus is enormously greater in the tissues of the tomato than in those of *N. glutinosa* (roughly of the order of 40 to 1).

**Legislative and administrative measures. Italy.**—*Internat. Bull. of Plant Protect.*, vii, 3, p. 61, 1933.

By a Ministerial Decree of 20th December, 1932, effective as from 1st March, 1933, the importation into Italy of plants and plant parts of the genera *Abies*, *Picea*, *Pinus*, *Pseudotsuga*, and *Tsuga* is prohibited. Other conifers may be imported subject to certification by the competent authorities as to freedom from *Rhabdocline pseudotsugae* [*R.A.M.*, xii, p. 258 *et passim*] and other dangerous diseases and pests.

**Gesetze und Verordnungen.** [Laws and regulations.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xiii, 3, p. 23, 1933.

NORWAY. By a Royal Decree dated 4th February, 1933, with immediate effect, the importation into Norway of living hop plants and cuttings is prohibited to avoid the risk of introducing the fungus *Peronospora* [*Pseudoperonospora*] *humuli*.

**United States Department of Agriculture. Bureau of Plant Quarantine. Notice of lifting phony Peach disease quarantine.**—1 p., 1933.

As from 1st March, 1933, the phony peach disease quarantine placed by Notice of Quarantine No. 67 on certain States and parts of States of the Union [*R.A.M.*, xi, p. 543] is revoked.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

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Laing (E. V.). **Elaphomyces sp. (false truffle) and tree roots.**—*Scottish Forestry Journ.*, xlvii, 1, pp. 14–18, 3 figs., 1933.

The writer has frequently observed the fructifications of species of *Elaphomyces* in Scotland in close pine and spruce stands, and also at times in association with larch, *Thuja plicata*, and beech roots. The fungus is widely distributed and the writer considers it to be the most common of all mycorrhizal fungi [cf. *R.A.M.*, xii, p. 183]. It is found under close canopy where there is little or no vegetation, but fructifications have not been seen where the canopy is open and herbaceous plants cover the soil.

La Rue (C. D.). **Intumescences on leaves of Eucalyptus cornuta, E. coccifera, Hieracium venosum, Mitchella repens, and Thurberia thespesioides.**—*Phytopath.*, xxiii, 3, pp. 281–289, 2 figs., 1933.

An account is given of the writer's observations in Michigan on the occurrence of intumescences of unknown causation on leaves of *Eucalyptus cornuta*, *E. coccifera*, *Hieracium venosum*, *Mitchella repens*, and *Thurberia thespesioides*. With the exception of those on the last-named host, all the intumescences under discussion may be described as 'mixed', since they combine the characters of hypertrophies and hyperplasias, being formed by the swelling and division of the epidermal and mesophyll cells or of only the latter. In *T. thespesioides* the outgrowths may show a few cell divisions, but they are mainly produced by the swelling of the regular mesophyll layers. Periderm formation occurred in all the outgrowths except those on *M. repens*. In *E. coccifera* the intumescences contain anthocyanin and thus appear as red spots on the foliage.

Greene (H. C.). **Variation in single spore cultures of Aspergillus fischeri.**—*Mycologia*, xxv, 2, pp. 117–138, 4 figs., 1 diag., 1933.

The writer obtained 448 monospore cultures from a stock culture of *Aspergillus fischeri* [*R.A.M.*, xii, p. 384], a perithecial form. Some of these monospore cultures showed striking morphological variations [full details of which are given] as compared with the parent culture. The variants fell into two main types: (1) characterized by very large, scattered perithecia in place of the small, closely and uniformly distributed bodies of the stock culture; and (2) marked by a profusion of conidia and scanty perithecial development, the contrary of the stock culture.

In one culture of type (1), successive subcultures, both from ascospores and conidia, reproduced the characters of the variant parent through several single spore generations. In another, however, single ascospore derivatives yielded cultures of practically identical morphology with the original stock for a number of generations, whereas conidial cultures reproduced the variant type. Monospore cultures from a type (2) variant reproduced the variant characters, whether ascospores or conidia were used.

NANNFELDT (J. A.). **Heterotalli och hybridisering hos rostsvampar. Litteraturöversikt.** [Heterothallism and hybridization in rust fungi. A review of the literature.]—*Svensk Bot. Tidskr.*, xxvii, 1, pp. 104–107, 1933.

A concise summary is given of some important contemporary studies in connexion with the problem of heterothallism and hybridization among the rusts. The papers under discussion have been fully noticed in this *Review*.

SANFORD (G. B.) & MARRITT (J. W.). **The toxicity of formaldehyde and mercuric chloride solutions on various sizes of sclerotia of Rhizoctonia solani.**—*Phytopath.*, xxiii, 3, pp. 271–280, 1 graph, 1933.

The writers tested at Edmonton, Alberta, various time-strength combinations of cold formaldehyde and standard and acidulated mercuric chloride on small (1·5 by 0·2 to 0·4 mm.), medium (2·5 by 0·5 to 0·7 mm.), and large (3·5 by 0·8 to 1·5 mm.) sclerotia of *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xii, p. 391].

The [tabulated] results of the experiments showed that after two hours' immersion in cold formaldehyde (1 in 240), 2 per cent. small, 19 per cent. medium, and 56 per cent. large sclerotia were still viable. A period of 480 minutes was necessary to kill all the large sclerotia. At a strength of 1 in 120 the lethal periods for the small, medium, and large sclerotia were 90, 180, and 270 minutes, respectively. The cold mercuric chloride solution (1 in 834) was more effective than any of the formaldehyde solutions used, destroying the small, medium, and large sclerotia in about 60, 130, and 150 minutes, respectively. The acidulated mercuric chloride solution (1 in 500 plus 1 per cent. by volume of hydrochloric acid) killed all the small sclerotia in 3, and the medium in 5 minutes, but 8 per cent. of the large ones were still viable after 5, and 2 per cent. after 13 minutes.

Both the acidulated and standard mercuric chloride solutions were found to be effective against the small and medium sclerotia up to the fifth successive immersion, and probably up to the eighth, for practical purposes, by lengthening the time in the solution.

Under the conditions of the trials (one season) the vitality of the potato sets was not reduced appreciably by cold formaldehyde, 1 in 120 up to 240 minutes; or 1 in 240 up to 470 minutes; cold mercuric chloride, 1 in 834 up to 120 minutes; and acidulated mercuric chloride, 1 in 500 up to 8 minutes.

From counts made on nine representative lots of potatoes the ratios of small, medium, and large sclerotia was 13 : 3 : 1.

ANDERSON (A. K.), EVERITT (E. L.), & ADAMS (P. D.). **The carbon metabolism of Fusarium oxysporum on glucose.**—*Journ. Agric. Res.*, xlvi, 5, pp. 473–482, 1 graph, 1933.

The results of the experiments described in this paper indicated that the main products of the metabolism of *Fusarium oxysporum* in a glucose-containing medium are carbon dioxide and ethyl alcohol, in a proportion which suggests that, like *F. lini* [*R.A.M.*, v, p. 441; vii, p. 592], this fungus causes a somewhat typical alcoholic fermentation. There was evidence, however, that while *F. lini* very definitely uses ethyl alcohol as a source of food [ibid., vii, p. 593], *F. oxysporum* makes only slight use of this product.

When cut potato shoots were placed in ethyl alcohol solutions up to a concentration of 5 per cent., they exhibited no symptoms of wilting, and developed a very striking odour resembling that of ripe cantaloupes, this suggesting, in the authors' opinion, that small quantities of alcohol are rendered non-toxic by conversion into an ester by the potato plant. Definite wilt symptoms were only shown when the cut shoots were placed in solutions of 10 per cent. and over, though it is thought quite possible that the actual concentration of the alcohol in the tissues was much below 10 per cent. While, therefore, there is no experimental evidence to support the theory that alcohol is responsible for the wilting of potato plants infected by *F. oxysporum*, there may be reasons to suppose that it is at least a factor in the production of the wilt symptoms.

FRIEBE (P.). **Zur elektrometrischen Messung des 'Abbaugrades' der Pflanzkartoffel. Eine praktische Erfahrung mit dem neuen Verfahren von Dr. Hay und Dr. Wartenberg.** [On the electrometric measurement of the 'degree of degeneration' of the seed Potato. A practical test by the new method of Dr. Hey and Dr. Wartenberg.]—*Pflanzenbau, Pflanzenschutz u. Pflanzenzucht*, ix, 9, pp. 351–355, 1 diag., 1933.

Making use of the method devised by Drs. Hey and Wartenberg at the Biological Institute, Berlin, for the determination of the ratio between oxidation and reduction processes in the resting potato tuber, the writer carried out a series of tests on Erstling [Duke of York] potatoes of known sound and 'degenerated' origin. The results of field observations completely confirmed the laboratory data, which showed that the electric tension between the elements of the apparatus ranges from 0 to −180 millivolts for healthy tubers and from −180 to −200 for those inclining to degeneration; below −200 degeneration in the progeny is practically a certainty. The applicability of the method on a large scale is briefly discussed, the cost of testing 30 tubers from a wagonload worth M. 1,000 being estimated at M. 15.

STEPHAN (J.). **Die Melaninbildung in der Kartoffel. Ein kritisches Referat.** [Melanin formation in the Potato. A critical review.]—*Pflanzenbau, Pflanzenschutz u. Pflanzenzucht*, ix, 9, pp. 356–365, 1 fig., 1933.

The writer summarizes the literature on melanin formation in potato tubers and discusses the conclusions regarding this phenomenon reached by different workers [*R.A.M.*, viii, p. 598]. There

is no basis for the view that the black discoloration developing on cooking is a sign of degeneration; it is, on the contrary, associated with active metabolism, especially as regards albumin production. In tubers affected by degeneration diseases the albumin metabolism is at a low ebb and discolorations do not develop. The possible application of the electrometric method for the determination of the oxidation-reduction potentials [see preceding abstract] to melanin formation is briefly discussed.

ITO (S.). **Primary outbreak of the important diseases of the Rice-plant and common treatment for their control.**—*Hokkaido Agric. Exper. Stat. Rept.* 28, 211 pp., 7 pl. (1 col.), 7 graphs, 1932. [Received May, 1933. Japanese, with English summary.]

The most important and widespread diseases of rice in Japan are stated to be blast (*Piricularia oryzae*), sesame leaf spot (*Ophiobolus miyabeanus*), and 'bakanae' (*Gibberella fujikuroi*) [*R.A.M.*, xi, pp. 398, 536–538, 800].

The hyphae of *P. oryzae* may be readily detected within the tissues of the straw and seeds harvested from diseased plants. The name 'paddy blast' commonly refers to the grains which become completely empty with dark greyish spots on the surface of the hull. On closer observation some grains appearing superficially sound are found to show a greyish discoloration of the scale-like glumes and rachids adhering to them after threshing, and for this phase of the disease the name 'glume blast' is proposed. Under dry conditions most of the conidia from the diseased straw and seeds remained viable for a year or more, while the mycelium survived for as long as $3\frac{3}{4}$ years. The conidia were killed when frozen in water but they withstood 45 days at 4° C., while some of the intracellular hyphae remained viable for the same period in a frozen condition. The overwintered conidia were clearly shown to be pathogenic to rice leaves. Seedlings from seeds with 'glume blast' symptoms nearly always died at an early stage and were covered with conidia of *P. oryzae*.

Numerous conidia (*Helminthosporium oryzae*) and hyphae of *O. miyabeanus* occur on and in the straw and seeds collected in diseased fields. Affected seeds may be entirely covered with a blackish growth but in relatively mild cases the hull often shows only rust-coloured spots, a symptom readily overlooked so that diseased seeds are frequently sown with healthy ones. Indoors the conidia and hyphae of *O. miyabeanus* survived for about two and over three years, respectively, while some of the hyphae persisted through the winter on dry ground but not in farmyard manure. The ascigerous stage of the fungus developed in culture, but continuous search for it in the fields has yielded uniformly negative results. Inoculation tests with overwintered conidia produced the typical leaf spot lesions on rice leaves, while blighted seedlings developed from 'rust paddy' seeds.

The principal results of the author's studies on the bakanae disease have already been noticed from a previous report [loc. cit.], but the following point is of interest. Seedlings arising from seeds smeared with the conidia (*Fusarium*) of the 'red paddy'

(so called from the salmon-coloured sporodochia along the suture line of the glumes) developed severe symptoms of bakanae, which also appeared in a much milder form on plants infected through the soil.

In addition to these three serious diseases, over 70 species of fungi have been recorded on rice straw in Japan. The pathogenicity of the following has been proved by inoculation experiments: *Alternaria oryzae* Hara, *Helicoma echinosporium* Ito et Sasaki n. sp., *Phyllosticta* sp., and *Epicoccum neglectum* [ibid., xi, p. 183]. *H. echinosporium* is characterized [according to the Latin diagnosis] by sterile, filiform, branched, hyaline to olivaceous, septate hyphae 2·4 to 7·2 $\mu$ in width; fertile, erect, simple, 0- to 5-septate, pale, later fuliginous or olivaceous hyphae, 24 to 120 by 3·6 to 4·8 $\mu$; and acro-pleurogenous conidia in groups of 3 to 6, cylindrical or long-ellipsoid, tapering and rounded at both ends, with uni- to biconvolute spirals near the apex, 1- to 14-septate, constricted at the septa, echinulate, olivaceous, and measuring 16·8 to 117·6 by 7·2 to 18 $\mu$ (mean 75·05 $\pm$ 0·708 by 11·34 $\pm$ 0·089).

Certain fungi [unspecified in the English summary] penetrate the tissues and finally attack the kernels, resulting in the so-called 'spoiled rice'.

The conidial death points of *P. oryzae, O. miyabeanus*, and *G. fujikuroi* subjected to various disinfectant treatments were as follows: copper sulphate, 2 per cent. for *P. oryzae*, undetermined for the other two; mercuric chloride, 0·05, 0·1, and 0·1 per cent., respectively; formaldehyde, 0·175, 0·25, and 0·7 per cent.; hot water (5 minutes), 52°, 54°, and 57° to 60°; hot water (10 minutes), 51°, 53° to 54°, and 54° to 55°. The corresponding figures for the internal hyphae were as follows: copper sulphate, 4 per cent. 48 hours for *P. oryzae*, ineffective against *O. miyabeanus*, and 1 per cent. 24 hours for *G. fujikuroi*; mercuric chloride, 0·1 per cent. 6 hours for *P. oryzae* and *O. miyabeanus*, ineffective against *G. fujikuroi*; formaldehyde, 0·7 per cent. 3 hours for *P. oryzae* and *O. miyabeanus*, 0·7 per cent. 1 hour for *G. fujikuroi*; hot water 55° 5 minutes for *P. oryzae*, ineffective against the other two. It is apparent from these results that copper sulphate is the least satisfactory of the treatments and formalin the most efficacious, mercuric chloride is moderately toxic but not to be generally recommended, while hot water is applicable only to blast. Great stress is laid on the necessity of excluding diseased straw from the rice fields.

NORMAN (A. G.). **The biological decomposition of plant materials. Part VIII. The availability of the nitrogen of fungal tissues.** —*Ann. of Appl. Biol.*, xx, 1, pp. 146–164, 2 graphs, 1933.

Continuing his studies on the biological decomposition of plant materials [*R.A.M.*, xii, p. 393], the author describes in some detail experiments in which he claims to have established that fungal tissue, as represented by killed mycelial pads of *Aspergillus versicolor*, *A. fumigatus*, *A. terreus*, *A. niger*, and mixed fungal and bacterial tissue, is as suitable a source of nitrogen to soil-inhabiting micro-organisms (mixed soil flora and pure cultures of certain

fungi) for the decomposition of straw as ammonium salts and nitrates. The work also comprised the determination of the amount of ammonia liberated from fungal tissue added to sand by pure cultures of reputedly active ammonifiers, and a comparison of its nitrification in soils with that of artificial mixtures of equal C/N ratio built up from glucose, cellulose, and straw, each with added inorganic nitrogen. A very clear correlation was found between the C/N ratio of the fungal material and the nitrogen nitrified, the nitrification increasing markedly as the C/N ratio decreased. There was no evidence to show the existence of a very resistant and unnitrifiable residue from the fungal tissue, incomplete nitrification being probably attributable to the attainment of biological equilibrium or of a state in which change is very slow.

BISBY (G. R.), JAMES (N.), & TIMONIN (M.). **Fungi isolated from Manitoba soil by the plate method.**—*Canadian Journ. of Res.*, viii, 3, pp. 253–275, 2 figs., 1933.

Using the technique outlined by W. B. Brierley and his collaborators and by S. A. Waksman [*R.A.M.*, viii, p. 126; xi, p. 470], the writers isolated 121 species of fungi belonging to 44 genera, together with about 20 fungi not yet identified, from 75 samples of various types of Manitoba soil. Critical and taxonomic notes are given on the species already determined.

The soils supporting plant life gave counts of fungi ranging from 18,000 to 350,000 per gm., the highest numbers being obtained from forest soils, though a lucerne field yielded 240,000 moulds in January and 195,000 in June. An immediate and consistent increase in the fungus population of a wheat plot followed the application of ammonium phosphate at sowing time at the rate of 45 lb. per acre. The long, cold winter of Manitoba does not appear to reduce the number of viable spores in the soil [cf. ibid., xii, p. 140].

Several parasitic fungi were isolated in the course of these experiments, including *Fusarium culmorum*, a prevalent agent of root rot in cereals [ibid., xii, p. 502], and *Helminthosporium sativum*, the latter represented by seven out of 7,000 colonies developing from 40 wheat plot isolations. The average number of fungi found in the wheat field was 90,000 per gm. of surface soil, so that each gram of a soil cropped to wheat for some time in Manitoba may contain 90 viable spores or mycelial fragments of *H. sativum* [ibid., xi, p. 169].

The results of culture experiments showed that *Trichoderma lignorum* is capable of completely overwhelming and destroying the colonies of *F. culmorum* and *H. sativum*, and it is suggested that the former organism may play an important part in reducing the activities of certain soil pathogens under natural conditions [cf. ibid., xii, p. 192].

NIETHAMMER (ANNELIESE). **Studien über die Pilzflora böhmischer Böden.** [Studies on the fungus flora of Bohemian soils.]—*Arch. für Mikrobiol.*, iv, 1, pp. 72–98, 3 figs., 1933.

From various types of soil (meadow, garden, arable, forest, etc.), in Czecho-Slovakia the writer isolated, among other organisms,

five species of *Fusarium* (including *F. discolor*, *F. solani*, and *F. oxysporum*), nine Mucoraceae, three species of *Penicillium*, *Aspergillus repens*, *Trichoderma koningi*, *T. lignorum*, and one species each of *Cephalosporium*, *Zygodesmus*, *Torula*, and *Dimerosporium* [cf. *R.A.M.*, xii, p. 191].

Many of the fungi grew well in culture on samples of the soils from which they were taken, indicating the probable presence in the natural substratum, not only of the spores but also of the mycelium. In certain cases where seeds and fungi were grown together in pure culture, both parties appeared to benefit from the association (e.g., *Mucor racemosus* with *Festuca pratensis* and *Poa pratensis*, peas with *T. lignorum*), a fact that may bear on the mycorrhiza problem [cf. ibid., xii, p. 309]. Uspulun-universal (0·00001 per cent.) increased the stimulatory effect in the joint cultures of *M. racemosus* and *P. pratensis*.

*F. solani* and *F. oxysporum*, *T. koningi* and *T. lignorum*, and *Penicillium glaucum* made good growth on sulphite cellulose.

MERKENSCHLAGER (F.). **Über das Brom in der Pflanzenpathologie.** [On bromine in phytopathology.]—*Pharmazeut. Zeit.*, lxxviii, 12, p. 162, 1 fig., 1933.

A survey is given of current observations by the writer and others of the action of bromine compounds, chiefly eosin, on seed germination and growth. The effects of this compound (the potassium salt of tetrabromofluorescein) take the form of disturbances in geotropism, and are already apparent at a dilution of 1 in 640,000. When seeds, e.g., of maize or lupin, are placed in eosin (1 in 100,000) and left over-night the roots grow upwards. Bromural exerts a definitely pathological action on barley roots, the caps of which are sloughed off.

LINDQUIST (J. C.). **Sobre la presencia de la 'Phytophthora capsici' en la Republica Argentina.** [On the presence of *Phytophthora capsici* in the Argentine Republic.]—*Physis*, xi, pp. 170–174, 1932.

A note is given on the occurrence in the chilli [*Capsicum annuum*] plantations of La Plata, Argentine Republic, of the fruit rot due to *Phytophthora capsici* [*R.A.M.*, xii, p. 496], which in 1932 caused a loss of 80 per cent. of the crop. The symptoms of the disease and the life-history of the causal organism, which was readily isolated and grown in artificial culture, are briefly described.

GHOSH (M. N.). **Yellowing of Sugarcane in the district of Saran in North Bihar.**—*Current Science*, i, 6, p. 162, 1932.

Co. 213 sugar-cane at the Government Farm, Sepaya, has been observed since 1925 to develop an extensive yellowing of the foliage between the months of July and September during breaks in the monsoon after heavy showers of rain. The symptoms appear suddenly on the tip of the fourth or fifth leaf and travel rapidly downwards. The old roots are found to have decayed and

no new ones are formed. The disturbance occurs on light soils and on those with a hydrogen-ion concentration of $P_H$ 9 or above. The affected leaves show an abnormally large accumulation of carbohydrates with a correspondingly low nitrogen content. Good results have been obtained by the application of nitrogenous and phosphatic fertilizers and by earthing up, the plants forming new roots, turning green, and resuming fresh growth. The disease would thus appear to be due to a deficiency of available nitrogen in the soil at a time when it is in heavy demand by the growing plants.

NEGODI (G.). **Su di alcuni Deuteromiceti nuovi.** [On some new Deuteromycetes.]—*Atti Soc. Nat. Modena*, lxiii, (Ser. VI, xi), pp. 40–45, 8 figs., 1932.

Taxonomic notes, accompanied by Latin diagnoses, are given of three new species of fungi from Somaliland, namely, *Gloeosporium somalense* on *Sansevieria robusta, Plenodomus nigricans* on *S. stuckii*, and *Phoma encephalarti* on *Encephalartos horridus,* of which only the first is considered to be a parasite.

The infected plants of *S. robusta* showed a wilting of the foliage, which was further characterized by an olive-black, concentric spotting of the subepidermal tissues (the lesions being subcircular or elliptical, 1 to 4 mm. in diameter) and in the later stages by longitudinal fissures. The disease assumed a very severe form and finally killed the plants. The oblong-cylindrical, continuous, hyaline conidia tapering at the base and measuring 21 to 27 by 3·5 to 5 $\mu$, are borne at the subhyaline apices of rod-shaped, fuliginous conidiophores arising from dark, oblong acervuli immediately below the epidermis of the host.

TRANZSCHEL (W. A.). О принадлежности ецидиев на Барбарисе к **Puccinia pygmaea Erikss.** [On the relationship of aecidia on Barberry to *Puccinia pygmaea* Erikss.]—*Comptes rendus Acad. des Sciences URSS, 1931*, pp. 45–48, [? 1931. German, with Russian summary.]

The purpose of this brief note is to draw the attention of phytopathologists to the occurrence on barberry (*Berberis vulgaris*) in the region of Leningrad and in the Russian Far East of the aecidial stage of *Puccinia pygmaea,* which macroscopically closely resembles that of *P. graminis* and may easily be confused with the latter. Microscopically the aecidia of *P. pygmaea* are indistinguishable from those of *P. arrhenatheri* [*R.A.M.*, x, p. 601], and both differ from those of *P. graminis* in that their spores are not thickened at the apex and have coarsely warted peridial cells, while those of *P. graminis* are covered with fine warts. The genetic relationship of the aecidia on barberry to *P. pygmaea* was conclusively demonstrated by the author's artificial inoculations of this host with teleutospores of the latter fungus collected in 1929 and 1930 from species of *Calamagrostis* in the neighbourhood of Leningrad. It is pointed out that, unlike *P. arrhenatheri, P. pygmaea* does not produce witches' brooms on barberry.

Viennot-Bourgin (G.). **Notes sur quelques Urédinales et Ustilaginales observées en 1931–1932 dans le département de Seine-et-Oise (région Sud).** [Notes on some Uredinales and Ustilaginales observed in 1931–1932 in the Department of Seine-et-Oise (south region).]—*Rev. Path. Vég. et Ent. Agric.*, xx, 2, pp. 85–114, 1933.

A catalogue is given of 109 rusts and 18 smuts found in the Seine-et-Oise Department in 1931–2, with notes on the biology of the fungi, the influence of climatic conditions on their development, and the relations between the aecidial form and the uredospore or teleutospore stage of heteroecious rusts. The stage of development of the host when the fungus appeared is indicated in each case.

Goidànich (G.). **Miceti Bolognesi. Contributo alla conoscenza della flora micologica della Provincia di Bologna. VI. Centuria.** [Bolognese fungi. A contribution to the knowledge of the mycological flora of the Province of Bologna. Sixth century.]—Reprinted from *Malpighia*, xxxii, 26 pp., 2 figs., 1932.

This list of fungi found in the province of Bologna now brings the number of species recorded for this locality up to six hundred. It includes, among others, the following records. *Sclerospora macrospora* was found on the leaves of *Triticum* and *Phragmites* during the spring, 1929–31, in wheat plots on mud flats near the river Samoggia, where the plants were liable to the flooding necessary for the development of the fungus [*R.A.M.*, x, p. 174]. In 1924–6, *Urophlyctis leproides* (Trabut) P. Magn. was observed on beet leaves. *Cephalosporium acremonium* forma *major* Penzig was found parasitizing *Penicillium crustaceum*, the parasitic behaviour being identical with that described by Penzig for attack on *Alternaria tenuis*.

Storey (H. H.) & Leach (R.). **A sulphur-deficiency disease of the Tea bush.**—*Ann. of Appl. Biol.*, xx, 1, pp. 23–56, 4 pl. (1 col.), 1933.

This is a full report of the authors' investigation of the tea yellows disease in Nyasaland, a preliminary account of which has already been noticed [*R.A.M.*, xi, p. 805]. The whole syndrome of the disease is that of a gradual degeneration ending in the death of individual shoots and branches, and finally of the whole tea bush. In the early stages there is little or no stunting of the leaves and internodes, but the leaves develop a yellow mottling, the network of veins remaining green. At a later stage the leaves and internodes become markedly stunted, and the mottling of the leaves gives way to a general severe chlorosis; the leaves tend to be somewhat uprolled and to develop brittleness, and frequently their tissue dies from the tip or edge, shrivelling to a dark brown colour. These symptoms become more accentuated as the disease advances; in extreme cases mature leaves are reduced to a length of not over 1·5 cm., the shoot being thin and weak with closely crowded nodes. All the leaves formed after the onset of the disease, except the

youngest, are shed, and lateral buds develop prematurely, producing stunted shoots with minute, yellow leaves. Eventually the terminal bud is killed and a gradual die-back of the shoot sets in. The final state is a leafless bush bearing many dead or dying thin shoots, although occasionally living axillary shoots may be found near the base. In young diseased plants the root system may be poorly developed, but in an old bush with an extensive root system no effect was observed upon the structure of the roots after the onset of the yellows disease. Severely diseased tea plants were shown usually to contain little or no starch reserve in their roots. From the histological standpoint, the small yellow leaves of an affected shoot appear to have been arrested in their development while still immature; their palisade layer is poorly differentiated, the mesophyll cells are crowded and more uniformly arranged, and the intercellular spaces are much reduced; the cell walls are thinner, and the stomata of the lower surface are more numerous in diseased than in healthy leaves. In the early stages of the disease the plastids are reduced in size and number, and apparently disappear entirely in severely diseased leaves.

The remainder of the paper is given to a detailed description of the experiments [the results of which have already been noticed from the earlier publication] which established that the cause of the disease is to be attributed to a soil deficiency in sulphur, and also to an account of control measures by means of applications of adequate fertilizers. The part played by *Rhizoctonia bataticola* [*Macrophomina phaseoli*] in the etiology of the disease was further studied, and it was concluded that this fungus is not concerned in the initiation of the trouble.

**North Florida Experiment Station.**—*Ann. Rept. Florida Agric. Exper. Stat. for the fiscal year ending June 30, 1932*, pp. 149–156, 2 figs., 1932. [Received June, 1933.]

L. O. Gratz states that downy mildew or blue mould of tobacco (*Peronospora hyoscyami*) appeared almost simultaneously on all the seed-beds of the various sections of Gadsden and Madison during the week of 22nd February, and was still rampant on some late-sown beds on 10th May [*R.A.M.*, xii, p. 402].

JENSEN (J. H.). **Leaf enations resulting from Tobacco mosaic infection in certain species of Nicotiana L.**—*Contrib. Boyce Thompson Inst.*, v, 1, pp. 129–142, 7 figs., 1933.

The leafy outgrowths or enations reported by Iwanowski and Dickson [cf. *R.A.M.*, i, p. 392] on mosaic tobacco and recently observed by Holmes on the leaves of *Nicotiana tomentosa* and *N. paniculata* affected with tobacco mosaic virus [ibid., xii, p. 119] were produced experimentally by the author on the two last-named hosts. They arise from the lower surface of the leaf as small, inverted, cup-shaped or double leaf-like protusions and surround (either wholly or, very occasionally, partly) some of the chlorotic areas in the leaf, which, usually more or less parallel to the larger veins, sometimes seem to be unrelated to the position of any vein. Enations form only on leaves developing after systemic infection has occurred. Similar outgrowths have been observed at

times, associated with tobacco mosaic infection, in *N. tabacum* var. *angustifolia*.

The enations begin as small paired ridges on the under side of a young leaf, and are due to an increase in the number of cell layers resulting from cell division in the lower three or four layers of tissue. The two protuberances are sometimes so close together that they are more or less merged; occasionally both appear to arise from the same point in the leaf, with the result that only one protuberance is seen. In the early stages all the cells are meristematic. Further development progresses by cell division in the small ridges of tissue. Cell division both in the malformation and the remainder of the leaf ceases when the leaf is three-quarters to one inch long.

The cells in the outgrowth quickly form seven distinct layers and begin differentiation with those of the corresponding layers of the rest of the leaf. In both, the palisade layer becomes differentiated first, this being followed by the appearance of conducting elements and spongy parenchyma. The area of the main leaf between the two wings of an enation usually at first resembles the rest of the leaf in cross-section, but sometimes cell development in this area becomes arrested, with the result that the leaf is thinner here than elsewhere; as the outgrowth develops, this area becomes chlorotic and remains thin. In a fully expanded leaf these chlorotic areas consist of undifferentiated cells containing small quantities of cytoplasm, very little chlorophyll, and poorly developed plastids.

On a fully grown leaf the two inner and the two outer sides of an enation always show an identical arrangement of the cell layers. Palisade parenchyma is present in the subepidermal cell layer of the two inner sides and often spreads across the lower side of the space between, forming a complete layer of palisade cells inside the enation. In other cases, the palisade development is restricted to the inner sides of the outgrowths. When palisade development is present at the bottom of a cup-shaped enation it is absent from the upper side of the leaf above this area. Palisade formation in the outgrowth occasionally precedes that in the main portion of the leaf.

Tissue similar to that usually found on the lower side of leaves is differentiated in the outer sides of the outgrowth. The cells of the second to the fifth layers from the outside develop into spongy parenchyma with large intercellular spaces, so that in cross-section a portion of a large outgrowth resembles a portion of the main leaf, containing seven layers of cells similar in size, shape, and arrangement to those of the rest of the leaf.

The production of enations on *N. paniculata* inoculated with tobacco mosaic may be prevented by partial shading.

JOHNSON (J.). **Cucumber mosaic on Tobacco in Wisconsin.**—*Phytopath.*, xxiii, 3, p. 311, 1933.

In 1932 the examination of samples from 60 tobacco plants, representing 25 fields in various parts of Wisconsin, revealed the presence of the typical cucumber mosaic virus [*R.A.M.*, xii, p. 108] in 26, of ordinary tobacco mosaic in 21, and of unidentified viruses, apparently distinct from either of these, in 13. In a field

at Madison, some 30 per cent. of the tobacco plants were affected by cucumber mosaic and a high percentage by tobacco mosaic, and the former disease is believed to have been still more prevalent in other parts of the State. More limited observations and experiments indicated a similar situation in respect of mosaic on tomato [cf. ibid., xii, p. 333]. The occurrence of cucumber mosaic in an epidemic form on tobacco appears, on the basis of past field records, to be unusual.

FRACANZANI (G. A.). **Mosaicatura del Tabacco.** [Tobacco mosaic.]—*Boll. Tecn. R. Ist. Sperim. Colt. Tabacchi 'Leonardo Angeloni'*, Scafati (Salerno), xxix, 4 (XI, 1932), pp. 244–247, 1933.

In this paper (reprinted from the *Giorn. Agric. Domenica*, 1st January, 1933), the writer briefly discusses the factors involved in the development of tobacco mosaic, which is stated to have devastated the valuable plantations of Salerno, Italy, in 1932 [cf. *R.A.M.*, vi, p. 395], and describes his preliminary experiments in the control of the disease by the injection of ferrous sulphate into the stems. The best results were given by four injections (each of 1 c.c.) of the compound at a strength of 3 per mille. The treated plants are stated to have lost all trace of mosaic, resumed vigorous growth, and given an abundant yield. Good control of the disease was also given by the same substance at 8 per mille, but the plants made poor growth, while the application of 5 or 10 per cent. solutions of ferrous sulphate to the soil by means of irrigation was ineffectual. The untreated plants suffered severely from mosaic.

SMITH (J. H.). **Streak in Tomatoes aseptically grown.**—*Ann. of Appl. Biol.*, xx, 1, pp. 117–122, 1933.

This is a brief report of the author's work [a reference to which has already been noticed from another source: *R.A.M.*, xii, p. 140], the results of which showed that when tomato plants were grown from sterile seeds under strictly aseptic conditions, it was possible by inoculation of bacteriologically sterile juice from infected plants to produce in them symptoms of tomato streak [ibid., xii, p. 250], a disease which is usually associated in nature with bacteria, without the development in them of the accompanying bacterial organisms. There was no evidence that the bacteria ordinarily found in naturally infected plants are derived from the virus, or the virus from these organisms.

The association of *Bacillus lathyri* with tomato streak or stripe [ibid., iii, p. 197] is, therefore, not necessarily an indication that it causes the disease.

BERKELEY (G. H.) & MADDEN (G. O.). **The transmission of streak and mosaic diseases of Tomato through seed. No. II.**—*Scient. Agric.*, xiii, 7, pp. 455–457, 1933. [French summary on p. 472.]

Continuing their studies on the transmissibility of the tomato streak and mosaic diseases [*R.A.M.*, xii, p. 250], the authors describe further experiments, the results of which showed that the mosaic is extensively transmitted through the seed, and that

the infective principle may be present in seeds from green as well as from ripe tomatoes produced by affected plants. It was found, however, that the seed from certain trusses of a mosaic plant may produce progeny exhibiting symptoms of mosaic, while seed from other trusses on the same plant may produce healthy plants under similar environmental conditions, a phenomenon which is not yet understood. From a practical standpoint, these experiments again emphasize the necessity for growers of greenhouse tomatoes of maintaining their own seed supply by means of a rigid selection from healthy plants, and of isolating their crops from sources of infection, since the mosaic produced by artificial inoculations with the crushed embryos of seed from mosaic plants was shown to be contagious and apparently similar in all respects to the ordinary tomato mosaic.

SMITH (K. M.). **Spotted wilt: an important virus disease of the Tomato.**—*Journ. Min. Agric.*, xxxix, 12, pp. 1097–1103, 3 pl. (1 col.), 1933.

This is a brief, popular account of the author's investigation up to date of the spotted wilt of tomato, which is now stated to be widely spread in England [*R.A.M.*, xii, p. 59]. Most of the information contained in it has already been noticed.

VAN POETEREN (N.). **Comité inzake bestudeering en bestrijding van de Iepenziekte. Jaarverslag over 1932.** [Committee for the study and control of the Elm disease. Annual Report for 1932.]—*Tijdschr. over Plantenziekten,* xxxix, 3, pp. 73–76, 1933.

The writer, in his capacity as secretary to the committee for the study and control of the elm disease (*Ceratostomella ulmi*) in Holland [*R.A.M.*, xii, p. 478], briefly reports on its activities during 1932. These included scientific papers and reports, a widespread publicity campaign through the press, exhibitions, lectures, and an investigation of the possibilities of control.

CORNELI (E.). **Moria degli Olmi prodotta da 'Graphium ulmi' Schwarz.** [Die-back of Elms produced by *Graphium ulmi* Schwarz.]—*Riv. Pat. Veg.*, xxiii, 1–2, pp. 27–31, 2 pl., 1933.

Die-back of elms (*Graphium* [*Ceratostomella*] *ulmi*) [*R.A.M.*, xii, p. 404] was first observed in Umbria in 1930, the attack being severe and the spread of infection extremely rapid.

Cultures from diseased material grown on barked elm twigs or in elm leaf decoction agar after a few days showed the presence of dark synnemata, usually in clusters of three or more arising from a common point of origin but spreading out; each averaged 300 to 400 by 25 to 30 $\mu$ and had a terminal cap measuring up to 120 $\mu$ in diameter; the non-septate, hyaline, round or slightly elongated spores averaged 2·5 to 3 by 2 to 3 $\mu$.

In carrot decoction and meat broth agar synnemata did not develop, but multiple budding of single spores occurred, producing a whitish, mucous layer at the edge of which a hyaline, septate, creeping mycelium developed, giving rise to short, unbranched, creeping or erect conidiophores bearing hyaline, non-septate conidia

measuring up to 8 by 3·5 $\mu$, some of which also budded. The mycelial layer tended to grow in concentric circles. This form may be referred to the form-genus *Cephalosporium* [cf. ibid., x, p. 632].

On elm extract agar there was no initial budding but a vigorous development of frequently sterile mycelium with the subsequent formation of tufts of dark coremia arising from a dense mycelial weft.

Inoculations of healthy, wounded elm twigs gave positive results with all these types of spore (*Graphium, Cephalosporium*, and the budding form).

In a few instances the prompt, complete excision of affected branches gave satisfactory results.

TINI (G.). **Prove di germinazione di spore di 'Oidium quercinum'.** [Germination tests of the spores of *Oidium quercinum*.]—*Riv. Pat. Veg.*, xxiii, 1–2, pp. 43–45, 1933.

After referring to the serious damage still caused to *Quercus* [*robur* var.] *sessiliflora* in the vicinity of Assisi by *Oidium quercinum* [*Microsphaera quercina*: *R.A.M.*, x, p. 278; xi, pp. 682, 767], the author states that repeated attempts [by methods which are described] to germinate the ascospores were unsuccessful, and they are thought to play no part in the overwintering of the fungus in Italy.

Experiments showed that the optimum temperature for the germination of the conidia in hanging drop cultures was about 18° to 20° C., at which temperatures germination was complete in 12 hours; at 25° it was halved, at 28° scarcely perceptible, and at 30° it ceased. When the conidia in hanging drop cultures were exposed to 0° for 24 hours and then removed to a temperature of 16° to 18°, they germinated normally; similar exposure to −3° gave about 50 per cent. germination, to −5° gave very little, and to −10° none. When leaves bearing conidia, however, were exposed for 24 hours to −10° and then removed to a normal temperature for germination, about 50 per cent. germination resulted, similar exposure to −7° giving about 60 per cent. germination, to −5° giving almost complete, and to higher temperatures complete germination.

It is concluded that in Italy *M. quercina* may overwinter on the host in the conidial stage.

HAAS (A. R. C.). **Walnut yellows in relation to ash composition, manganese, iron, and other ash constituents.**—*Bot. Gaz.*, xciv, 3, pp. 495–511, 2 figs., 1933.

A fully tabulated account is given of the writer's comparative analyses of certain ash constituents in a large number of samples of healthy walnut bark and leaves and those affected by yellows in California [*R.A.M.*, viii, p. 207]. The ash content of the diseased bark was higher than that of the healthy, and the former generally showed more magnesium, manganese, and inorganic phosphate than the latter. The magnesium, inorganic phosphate, manganese, and iron contents were higher in diseased than in healthy foliage, and manganese was also not deficient in the few rosetted pecan

leaf samples examined at the same time. Walnut yellows cannot, therefore, be attributed to manganese deficiency [ibid., xi, p. 326 *et passim*] unless a considerable amount of this substance is unavailable.

MIELKE (J. L.). **Tuberculina maxima in western North America.** *Phytopath.*, xxiii, 3, pp. 299–305, 1933.

*Tuberculina maxima*, a parasite of several pine rusts in North America, has now been found on white pine blister rust (*Cronartium ribicola*) on *Pinus monticola* [ibid., xii, p. 407] and on *C. comptoniae* on *P. contorta* [ibid., xi, p. 616]. On *C. ribicola* it occurs in British Columbia and Washington, while on *C. comptoniae* it has been found only in British Columbia. The parasite is not considered to be an important factor in the control of white pine blister rust.

BAXTER (D. V.). **Some resupinate Polypores from the region of the Great Lakes. IV.**—*Papers Michigan Acad. Science, Arts and Letters*, xvii, pp. 421–439, 10 pl., 1933.

Continuing his key to the resupinate Polypores of the Great Lakes region of the United States [*R.A.M.*, xi, p. 552], the writer gives critical and taxonomic notes on the brown species studied on conifers and hardwoods during the last few years. The genera chiefly represented are *Poria, Fomes, Polyporus*, and *Trametes*. Even such a common and well-known species as *F. igniarius* presents a complicated problem on appearance in a resupinate form, and similar difficulties are encountered in the study of *F. igniarius* var. *nigricans*, *Poria betulina*, and others. Preliminary cultural studies of several of these brown types indicate that the characteristic growth forms developing under these conditions may be used to supplement the usual microscopic features in the work of identification. Marked differences in mycelial growth [shown in a table] were observed between *F. igniarius* var. *nigricans*, *P. betulina*, *P. prunicola*, and *P. punctata*.

ROBAK (H.). **On the growth of three wood-destroying Polyporeae in relation to the hydrogen-ion concentration of the substratum.**—*Svensk Bot. Tidskr.*, xxvii, 1, pp. 56–76, 4 graphs, 1933.

At the University of Oslo, Norway, *Polyporus* [*Polystictus*] *zonatus* [*R.A.M.*, vii, pp. 205, 689], *Polyporus fuliginosus* (*P. benzoinus*), and *P.* [*Fomes*] *annosus* were cultured on sterilized pine (*Pinus sylvestris*) sawdust adjusted to different hydrogen-ion concentrations by the addition of hydrochloric acid or sodium carbonate. The growth range for *Polystictus zonatus* was found to extend from $P_H$ 4·5 to between 6·3 and 6·5, that for *F. annosus* from 4·0 to 6·3, and that for *Polyporus benzoinus* from 4·0 to nearly 6·0. The optimum concentration for the growth of *Polystictus zonatus* appears to be about $P_H$ 5·5, a figure agreeing with the values often found in the wood of deciduous trees such as birch (*Betula alba*) and alder (*Alnus incana*). The corresponding point for *Polyporus benzoinus* lies between $P_H$ 4·5 and 5·0, a frequent reaction in *Picea excelsa* and *Pinus sylvestris* according to

H. Glømme (*Meddel. Norske Skogforsøksvesen*, iii, 1, 1928), and for *F. annosus* between 5·3 and 5·8. In the case of the last-named fungus the soil reaction appears to be more important than that of the wood. *Polystictus zonatus* intensified the acidity of the medium, whereas *F. annosus* increased alkalinity.

CAMPBELL (A. H.). **Zone lines in plant tissues. I. The black lines formed by Xylaria polymorpha (Pers.) Grev. in hardwoods.**—*Ann. of Appl. Biol.*, xx, 1, pp. 123–145, 3 pl., 1933.

From a brief review of the literature dealing with the zone lines formed in timber by wood-decaying fungi [*R.A.M.*, iv, p. 385] the author suggests that they may be classified into three groups: lines due to the antagonism of the mycelia of two fungi, those formed from the mycelium of a single fungus, and those due to the production of 'wound gum'. He gives a detailed account of his investigation of the development of *Xylaria polymorpha* [ibid., vii, p. 645] on artificial media and wood blocks, in the course of which he witnessed the formation by this fungus of black lines in the inoculated wood blocks and in the cotton-wool plugs supporting the blocks at the bottom of the test-tubes. It was found that these lines in reality are the sectional outlines of continuous egg-shaped shells enclosing a matrix of the substratum. The black line itself consists of a dense mass of brown bladder cells of the fungus occupying the lumina of the wood vessels, fibres, and cells of the medullary ray in the path of the line. Apparently the position which the black line is to occupy is at first marked out by the aggregation of thin, hyaline hyphae which later swell up and become closely septate. The bladder cells first make their appearance in rows of isolated patches of irregular shape, then gradually the intervening spaces are filled with the brown hyphae and the line begins to assume a sharply defined appearance. Some of these cells then collapse, and their contents stain the walls of the vessels, penetrate the pits between the cells of the medullary ray, and fill the interstices between the other bladder cells, forming a closely packed barrier almost impenetrable to other invading organisms. It was also found that the black line is always much harder than the surrounding wood, a fact which allowed of dissecting it out as a sheet several inches in area from sufficiently decayed wood. When a portion of the egg-shaped shell represented by the black lines becomes exposed, it gives rise to an effused black mycelium from which develops the stroma or fructification of the fungus, bearing the conidia and the perithecia. As a result of the study, it is suggested that the black lines are the marginal zones of entostromata comparable to those that occur in *Diaporthe*, and it is stated that the black lines produced in the genera *Nummularia*, *Ustulina*, *Hypoxylon*, and *Daldinia* are of similar structure and significance to those of *X. polymorpha*.

An account is also given of a *X. polymorpha* black mycelial line superimposed upon the 'wound gum' zone line formed by the attack of *Fomes applanatus* [*Ganoderma applanatum*] in beech wood, and it is suggested that the confusion existing in the literature on the zone lines of *G. applanatum* is in part attributable to this not uncommon phenomenon.

FRITZ (C[LARA] W.). **Rate of deterioration due to decay in pulpwood storage piles.**—*Pulp and Paper of Canada*, xxxiv, 3, pp. 191, 210, 1933.

The annual loss to the pulp and paper industry of Canada through deterioration of wood in the block pile is computed at a minimum of $5,000,000, and a study of the rate of deterioration in storage piles due to decay was therefore initiated by the Forest Products Research Laboratories [*R.A.M.*, xii, p. 345]. So far, one sample lot of 50 4 ft. sticks (spruce and fir) has been analysed, 25 of 1928 and 25 of 1930 storage. The former were found to contain approximately 1 per cent. more advanced rot than the latter, accompanied by a 0·3 per cent. reduction in pulp yield. The amounts of incipient rot in the 1928 and 1930 piles were 28·80 and 22·79 per cent., respectively, while the incidence of stain [*Ceratostomella* spp.] was 30·45 per cent. in the former as compared with 6·33 per cent. in the latter.

SANBORN (J. R.). **Development and control of microörganisms in pulp and paper mill systems.**—*Journ. of Bact.*, xxv, 1, pp. 70–71, 1933.

This is an abstract of a paper read before the thirty-fourth Annual Meeting of the Society of American Bacteriologists, 28th to 30th December, 1932. The slime-forming organisms in American pulp and paper mills cause discoloration and deterioration of the raw and finished products which result in impaired quality. The predominant slime-forming micro-organisms vary from mill to mill and include bacteria, algae, and moulds. Serious damage, associated with the formation of doughy or rubbery bodies, is caused by fungi of the *Oidium-Monilia* group. Another troublesome type of slime is that induced by *Aspergillus fumigatus* and other cellulose-destroying fungi forming dense, tangled masses of growth. To this group also belong species of *Chaetomium*, *Cladosporium*, *Acrostalagmus*, *Alternaria*, *Trichoderma*, and *Penicillium* [cf. *R.A.M.*, xii, p. 69], which are among the most active agents of pulp deterioration and discoloration. Effective control of micro-organisms in paper manufacture may be accomplished by water purification processes, localized chemical treatments, mill sanitation, and special preservative methods.

NEUWIRTH (F.). **Schädlinge und Krankheiten der Rübe im Jahre 1932.** [Pests and diseases of Beet in the year 1932.]—*Zeitschr. für Zuckerind.*, lvii, 27, pp. 209–215, 1 graph, 1933.

A severe outbreak of heart and dry rot of beets [*R.A.M.*, xii, p. 135] was reported from many parts of Czecho-Slovakia as a sequel to the August (1932) heat wave, the most virulent phases of the disease prevailing in the second week of September, though cases were observed as early as July. Similar conditions obtained in respect of scab [loc. cit.]. Nearly all the severe damage occurred in the central and eastern districts, where heavy rains punctuated the dry spell; in southern Moravia and Slovakia, where the drought was uninterrupted, the injuries were relatively slighter. The diseased beets were so unsuitable for sugar manufacture that they were rejected by some of the factories.

Leaf spot (*Cercospora beticola*) was also very prevalent in the eastern districts. A highly virulent bacterial disease caused extensive rotting and interfered with sugar manufacture even more than did the heart and dry rot. Considerable losses were caused by root rot of the germinating stands [*Pythium de Baryanum*, *Phoma betae*, and *Aphanomyces levis*: ibid., x, p. 425; xi, p. 559]. The following diseases were of minor importance: downy mildew (*Peronospora schachtii*), red rot (*Rhizoctonia violacea*) [*Helicobasidium crocorum*], and rust (*Uromyces betae*) [ibid., xii, p. 317].

WEBER (G. F.). **Some diseases of Cabbage and other Crucifers in Florida.**—*Florida Agric. Exper. Stat. Bull.* 256, 62 pp., 47 figs., 1932.

Popular descriptions are given of the following crucifer diseases in Florida, with notes on control where practicable, the more important disorders being very fully treated: black rot (*Bacterium campestre*) [*Pseudomonas campestris*], watery rot (*Sclerotinia sclerotiorum*), downy mildew (*Peronospora parasitica*), powdery mildew (*Erysiphe polygoni*), rhizoctoniose, damping-off, wire stem, root rot, stem lesions, and bottom rot, all due to *Corticium vagum* (*Rhizoctonia solani*) [*C. solani*: *R.A.M.*, xi, p. 417; xii, p. 133], blackleg (*Phoma lingam*), grey mould (*Botrytis cinerea*), *Alternaria* leaf spots (*A. brassicae* (Berk.) Sacc. and *A. herculea* (E. & M.) Elliott) [*A. circinans* (B. & C.) Bolle and *A. brassicae* (Berk.) Bolle: ibid., iv, p. 61], white rust (*Albugo candida*) [*Cystopus candidus*], anthracnose (*Colletotrichum higginsianum* Sacc.), soft rot (*Bacillus carotovorus*), mosaic, mould (*Rhizopus nigricans*), black root of radish (*Aphanomyces raphani*) [ibid., xii, p. 350], white spot of pe-tsai [*Brassica pekinensis*], radish, and turnip (*Cercosporella albomaculans*) [ibid., vii, p. 213], and leaf spots of radish and *B. pekinensis* (*Cercospora cruciferarum* and *C. bloxami*, respectively), and *C. nasturtii* on watercress (*Radicula nasturtium-aquaticum*) [*Nasturtium officinale*].

HOLMES SMITH (E.). **Celery blight control. (Septoria apii, Bri. & Cav.).**—*Gard. Chron.*, xciii, 2412, pp. 193–194, 3 figs. (1 on p. 185), 1933.

Commenting on the fact that H. H. Stirrup's and J. W. Ewan's bulletin on the control of celery diseases [*R.A.M.*, xi, p. 91] is too little known among the growers of the north-western part of England, the writer states that considerably less than half the samples of local seed inspected during 1931–2 at Manchester University showed an average of under 40 per cent. infection by late blight (*Septoria apii*), while in the majority of the remainder the percentage of disease was well above this figure (up to 83 per cent.). No appreciable reduction of germination followed the immersion of the seed for three hours in a very dilute formaldehyde solution (1 in 300 to 400); in some cases, on the contrary, increases up to 26 per cent. were recorded as a result of treatment, especially in old seed. Excellent growth was made by plants from treated seed sown in frames of which the soil was sterilized with 2 per cent. formaldehyde, and no further fungicidal applications were

found to be necessary. On the other hand, the plants from untreated seed in unsterilized frames made poor growth from the start and were heavily attacked by *S. apii*. Local growers are reluctant to apply copper containing fungicides during the growing period to plants destined for consumption, partly on account of the extra trouble and also because the celery is largely eaten in the raw state. These objections, however, are not raised in cases where the plants are grown for seed, since it is generally recognized that spraying confers additional protection against blight.

The average weight of the plants from treated seed grown in treated soil in the writer's experiments was 4 lb. 14½ oz., compared with 1 lb. 10½ oz. for the untreated, the corresponding market values per dozen being 2*s*. to 2*s*. 6*d*. and 4*d*. to 6*d*. (at the most).

Bryan (Mary K.). **Bacterium cucurbitae on Cucumber.**—*Phytopath.*, xxiii, 3, p. 309, 1 fig., 1933.

Contrary to the writer's previous observations in the United States, H. H. Prasad found infection by bacterial leaf spot (*Bacterium cucurbitae*) on cucumbers in India [*R.A.M.*, x, p. 639]. Subsequently the disease was also found in a mild form on cucumbers by O. C. Boyd in Massachusetts, where it is believed to have spread from heavily infected squash plants. Cross-inoculation experiments between squash and cucumber gave positive results. On the latter host the lesions may be round or somewhat angular, the thin, papery, brown centre having a reddish-brown margin, sometimes surrounded by a yellow halo. There is sufficient similarity between this disease and angular leaf spot [*Bact. lacrymans*] to render field identification difficult.

Porter (D. R.) & Jones (H. A.). **Resistance of some of the cultivated species of Allium to pink root (Phoma terrestris).**—*Phytopath.*, xxiii, 3, pp. 290–298, 1 fig., 1933.

A tabulated account is given of the writers' experiments at Davis, California, to determine the reaction to pink root (*Phoma terrestris*) of 17 onion (*Allium cepa*) varieties and of five other species of *Allium* grown in infested soil.

Most of the onion varieties proved highly susceptible, though some degree of resistance was shown by Sweet Spanish, Valencia, and Prizetaker. Ailsa Craig, Michigan Yellow Globe, Australian Brown, Southport Yellow Globe, Southport Red Globe, Yellow Globe Danvers, Ohio Yellow Globe, and Extra Early Red Flat were among the most susceptible varieties (all over 90 per cent. infection), while a high incidence of pink root (90·1 and 91·4 per cent., respectively) was also recorded on shallots (*A. ascalonicum*) and garlic (*A. sativum*). Extreme resistance characterized the leeks (*A. porrum*), chives (*A. schoenoprasum*), and Nebuka (*A. fistulosum*) used in the tests [*R.A.M.*, xii, p. 416].

Snyder (W. C.). **A new vascular Fusarium disease of Peas.**—*Science*, N.S., lxxvii, 1996, p. 327, 1933.

A disease closely resembling the pea wilt due to *Fusarium orthoceras* var. *pisi* [*R.A.M.*, xii, p. 71] but caused by a distinct species of the same genus has been observed in Wisconsin, Mary-

land, and Delaware, while specimens were also received from New Hampshire, Massachusetts, Idaho, and Montana. Affected plants show a yellowing of the foliage, recurving of the leaflets and stipules, premature stunting, and a bright orange or reddish staining of the vascular elements for some distance up the stem. An important feature of the 'near wilt' disease is its occurrence on varieties known to be immune from *F. orthoceras* var. *pisi*. The causal organism of the new disturbance is characterized in culture by a purple pigmentation and the production of an abundance of spores, including macroconidia, the latter being practically absent from cultures of *F. orthoceras* var. *pisi*.

KOBEL (F.). **Die Aussichten der Immunitätszüchtung bei der Rebe.** [The prospects of breeding for immunity in the Vine.] —*Annuaire Agric. de la Suisse*, xlvii, 2, pp. 248–271, 1933. [French summary.]

The results [which are fully described and tabulated] of studies extending over a considerable period at Wädenswil, Switzerland, on the mode of inheritance of various characters in the vine indicate that, whereas sex, autumnal coloration of the foliage, and colour of the juice follow Mendelian laws, the transmission of resistance to *Peronospora* [*Plasmopara viticola*] and to low temperatures is of a more complex order. It must be assumed, therefore, that the American parents used in the hybridization experiments, *Vitis riparia*, *V. rupestris*, and *V. berlandieri* (which though not completely immune from mildew do not permit the fungus to spore freely on them in the open) are heterozygotic in respect of these characters.

A consideration of the results hitherto obtained in the hybridization trials under discussion does not offer any immediate prospects of successful breeding for immunity, but this character may ultimately be developed by the careful selection of $F_1$ hybrids between high grade but susceptible *V. vinifera* and the resistant *V. berlandieri* × *V. riparia* types, the crossing of these hybrids either among themselves or with other $F_1$ stock of proved value, e.g., Oberlin 595, and further selection on the same lines in the $F_2$ generation. On the basis of the observations hitherto made in this connexion, some six plants in 100,000 may be expected to combine, as the result of judicious selection, the necessary productivity and other desirable qualities with resistance to *P. viticola*.

HUSFELD (B.). **Über die Züchtung plasmoparawiderstandsfähiger Reben.** [On the breeding of Vines resistant to *Plasmopara*.] —*Gartenbauwissensch.*, vii, p. 15, 1932. [Abs. in *Fortschr. der Landw.*, viii, 10, p. 236, 1933.]

This is a discussion of vine breeding on modern genetical lines with the practical object of obtaining resistance to *Plasmopara* [*viticola*]. A method is described of artificial inoculation with the fungus and its maintenance over the winter on the green leaves. By means of mass infections under optimum conditions for the fungus it was possible to test a very large number of vine seedlings for resistance to *P. viticola* [see preceding abstract].

SMALL (T.). **Report of the Mycologist.**—*Rapports aux États de Jersey pour l'année 1932*, pp. 32–61, 1933.

Field tests in Jersey of the disinfection against attack by *Phytophthora infestans* of potato tubers destined for seed [*R.A.M.*, xii, p. 110] with formalin or copper sulphate and caustic soda gave 0·08 and 1·7 per cent., respectively, diseased tubers, as compared with 22·7 and 34·5 per cent. in the controls. In fumigation experiments to control the development of the disease in transit, potatoes dug from a diseased crop were sent to Weymouth and back in a barrel the sides of which had been sprayed with 100 c.c. of 40 per cent. formaldehyde; only 14 per cent. were diseased, as compared with 69 per cent. in another barrel sprayed with water, but the tubers in the formalined barrel were spotted.

Notes are given on the following diseases of tomatoes: *P. infestans*, stem canker due to *Didymella lycopersici* (this disease ranking second in importance to blight on outdoor tomatoes and causing serious damage on crops where *P. infestans* had been checked by spraying), blotchy ripening due to potash and nitrogen deficiency, stripe disease [ibid., xi, p. 494] and leaf mould (*Cladosporium fulvum*) [ibid., xii, p. 194].

Dead potato haulms of Kerr's Pink variety in the field showed the presence of pycnidia closely resembling and perhaps identical with those of *D. lycopersici* [ibid., xi, p. 809].

SĂVULESCU (T.). **L'état phytosanitaire en Roumanie durant l'année 1930–1931.** [Phytosanitary conditions in Rumania during the year 1930–31.]—*Inst. Cerc. Agron. al Romaniei Publ.* 8, 31 pp., 4 figs., 1932. [Rumanian, with French translation. Received July, 1933.]

Continuing his annual reports [*R.A.M.*, xi, p. 156], the author states that in Rumania in 1930–1 wheat suffered but little from attacks of the three rusts *Puccinia triticina* (chiefly biologic form XIII), *P. glumarum*, and *P. graminis* [ibid., xii, p. 426]. Loose smut (*Ustilago tritici*) was fairly widespread, especially on wheat varieties or pure lines resistant to the rusts. In the Danube Valley barley suffered heavily from loose smut (*U. nuda*) and covered smut (*U. hordei*), the first of which in some localities destroyed as much as 50 per cent. of the crop. The most important disease of rye was bunt (*Tilletia secalis*) [ibid., xi, p. 233] which sometimes caused losses of up to 80 per cent.

Sugar beet, especially in the northern provinces, suffered heavily from leaf spot (*Cercospora beticola*) [ibid., xii, p. 349], which reduced the yield by as much as 40 per cent. in some places. In Bukovina some leaf spotting was caused by *Ramularia betae* [ibid., xi, p. 147; xii, p. 135]. Heart rot (*Mycosphaerella tabifica*) [ibid., vii, p. 364] continued to be very prevalent and severe on soils unfavourable for the cultivation of sugar beet, with a reaction of $P_H$ 7·2 to 7·6 and with a calcium carbonate content of 3 to 6 per cent. Anthracnose of chick peas (*Ascochyta rabiei*) [ibid., xii, p. 137], which hitherto had been recorded only in the province of Braila, spread to new areas presumably by means of infected seed.

*Sclerotinia fuckeliana* [ibid., xi, p. 222] caused very appreciable

rotting of grapes in some regions. In Bukovina the opium poppy [*Papaver somniferum*] was severely attacked and damaged by a leaf spot caused by *Entyloma fuscum* Schroet. The leaf spot on *Yucca filamentosa* caused by *Coniothyrium concentricum* [ibid., xi, p. 22] was observed in several localities, this being believed to be the first record from Rumania. Black canker (*Physalospora cydoniae*) [ibid., xi, p. 656], hitherto known to occur on apples only in Bessarabia and Moldavia, was found to have spread to the rest of the country.

SIEMASZKO (W.). **Quelques observations sur les maladies des plantes en Pologne.** [Some notes on plant diseases in Poland.] —*Rev. Path. Vég. et Ent. Agric.*, xx, 3, pp. 139–147, 1 pl., 1933.

Further notes are given on the more important or rare plant diseases observed by the author in Poland in recent years [cf. *R.A.M.*, x, p. 775], among which the following may be mentioned. It is believed that the chief source of the severe infection of wheat by black rust (*Puccinia graminis*) in 1932 was from uredospores carried by the wind from Hungary and the Balkans [ibid., xii, p. 426]. Buck-wheat [*Fagopyrum esculentum*] is frequently attacked in central Poland by downy mildew (*Peronospora ducometi*) [ibid., viii, p. 422]; *P. fagopyri* recently described by Jaczewski in his monograph of the Phycomycetes [ibid., xi, p. 273] is considered to be identical with the Polish fungus. Hydrangeas in Warsaw are stated to be fairly frequently subject to attacks of *Oidium hortensiae* [ibid., xii, p. 175], and perithecia of the fungus were found in 1930 on this host; contrary to Blumer's views [ibid., vii, p. 447] the perithecia obviously belong to the genus *Microsphaera*; they are globose, black, 110 to 120 $\mu$ in diameter, and are supplied with from 10 to 20 hyaline or brownish, rigid, occasionally bifurcated appendages, branched at the apex and measuring 100 to 130 $\mu$ in length. Only immature asci and spores were seen. The asci were ellipsoidal or ovoid, 4- to 6-spored, and 38 to 44 by 30 to 36 $\mu$, while the spores were ellipsoidal, hyaline, and 20 to 22 by 8 to 10 $\mu$. The fungus is considered to be new to science, and is named *M. polonica*, a Latin diagnosis being given. *Entyloma dahliae* [ibid., xi, p. 624] was observed for the first time in Poland in 1925 on young *Dahlia variabilis* plants.

*Melampsora abieti-caprearum* [ibid., v, p. 335] was found on the needles of *Abies alba* in 1930, *Ungulina annosa* [*Fomes annosus*] on *Pinus strobus* and *P. mughus* (a new host for Poland) in 1933, *Rhizina inflata* [*R. undulata*: ibid., ii, p. 431] on *P. sylvestris* in 1929 (previously reported on conifer seedlings in commercial nurseries), and *Dasyscypha calycina* [ibid., xi, p. 141] on a young *P. cembra* tree in 1924. *Hadrotrichum virescens* [ibid., xi, p. 722] is stated to be frequent on *Agrostis alba* in the neighbourhood of Warsaw. *Polygonum auberti* was attacked by a new species of *Ustilago* which is named *U. raciborskiana*, with a Latin diagnosis. The fungus attacks the inflorescences, causing the formation of witches' brooms. Its spores are reticulate and measure 7·5 to 10 $\mu$ in diameter.

CONNERS (I. L.). **Twelfth Annual Report of the Canadian Plant Disease Survey 1932.**—*Canada Dept. of Agric., Exper. Farms Branch*, 112 pp., 1933. [Mimeographed.]

Notes are given on the incidence of fungous, bacterial, and non-parasitic diseases on cereals, fodder crops, potatoes and other vegetables, fruit, forest and shade trees, tobacco, and ornamental plants in Canada during 1932 [cf. *R.A.M.*, xi, p. 495]. Several diseases were reported for the first time, the most important being bacterial wilt of maize (*Bacterium* [*Aplanobacter*] *stewarti*) [see below, p. 562], which caused heavy losses in three counties of Ontario and scattered infections in nine others. Another new record was the narcissus blight caused by *Ramularia vallisumbrosae* [ibid., xi, p. 786], which occurred in a destructive form at Cowichan Station, British Columbia, killing the leaves from the tips to the ground, and was also observed in a number of private gardens at Saanichton.

UPPAL (B. N.). **Appendix L. Summary of work done under the Plant Pathologist to Government, Bombay Presidency, Poona, for the year 1931–32.**—*Ann Rept. Dept. of Agric. Bombay Presidency for the year 1931–32*, pp. 225–230, 1933.

Much of the information in this report has already been noticed from other sources, but the following items are of interest. One application of sulphur at flowering time usually suffices for the control of powdery mildew of peas [*Erysiphe polygoni*], the cost of the treatment being about Rs. 2 [3s. 0*d.*], and the quantity of sulphur required amounting to 25 lb. per acre. A second application may be given, if necessary, when the pods are formed and are still flat.

A species of *Alternaria*, believed to be new to science, causes a blight of cumin [*Cuminum cyminum*]. The incubation period of the fungus is three days, the infected plants collapsing within a week.

Further tests in the control of fig rust [*Cerotelium fici*: *R.A.M.*, xi, p. 282] indicated that 100 lb. of sulphur for five applications is the minimum quantity necessary to ensure reliable results. The fungicidal value of the sulphur was not appreciably impaired by the admixture of talc up to 20 per cent. of the weight of sulphur. The incubation period of the rust was found to be 14 days.

A race of bacteriophage has been isolated specific for *Pseudomonas citri*, the agent of citrus canker.

*Sclerotium rolfsii* was recorded on cotton, for the first time in the Bombay Presidency.

MCRAE (W.). **India: new diseases reported during the year 1932.**—*Internat. Bull. of Plant Protect.*, vii, 4, pp. 79–80, 1933.

Among the new plant diseases investigated in India during 1932 may be mentioned red stripe of sugar-cane (*Phytomonas rubrilineans*) [*R.A.M.*, xii, p. 245], *Sclerospora* sp. on *Panicum trypheron*, and *Polyporus ostreiformis* [ibid., vii, p. 704] causing heavy damage on areca palm [*Areca catechu*] in Calcutta.

WALLACE (G. B.). **Report of the Mycologist.**—*Ann. Rept. Dept. Agric. Tanganyika Territory 1932*, pp. 76–80, 1933.

During the period under review coffee rust (*Hemileia vastatrix*) in Tanganyika was most effectively controlled by two applications of Bordeaux mixture at half strength or one at full strength before the beginning of the heavy rains in March, followed by one half-strength application towards the end of the rainy period. *Cercospora coffeicola* was very abundant but was least common where the trees had been sprayed against *H. vastatrix* and in seed-beds shaded with pigeon pea. In one cacao plantation pod rot associated with a *Phytophthora* (?*faberi*) [*P. palmivora*] was abundant. Two species of *Rosellinia* were also recorded on the same host.

Maize was affected by head smut [*Sorosporium reilianum*: see below, p. 563] and the ear rots due to *Gibberella* [*moniliformis* and *G. saubinetii*: *R.A.M.*, xii, p. 201] and (in decreasing order of prevalence) *Diplodia macrospora*, *D. zeae*, and *D. frumenti*. Head smut appears to be confined to elevations of 5,000 ft. and over, one native plantation at 5,000 ft. showing complete loss of crop from this disease. Other fungi recorded on maize (old stalks) were *Phaeocytostroma ambigua*, *Melanconium saccharinum* (apparently new on this host), *Leptosphaeria orthogramma*, and *Clasterosporium lindavianum*.

Downy mildew [*Sclerospora* sp.: cf. ibid., ix, p. 373; xi, p. 634] caused considerable losses on sorghum; the Bonganhilo variety proved to be practically immune whilst Jebere, Karachi, Bangara, and Lugundugundu in a trial at Morogoro gave 9·6, 5·9, 10·8, and 10·7 per cent. infection, respectively. The value of sulphur treatment against sorghum smuts [*Sphacelotheca sorghi* and *S. cruenta*: ibid., xi, p. 235] was demonstrated and the method is being introduced into practice.

Sugar-cane suffered from a root disease due to *Armillaria* [*mellea*], probably the first record on this host. *Melanconium sacchari* and *Leptosphaeria sacchari* were also observed on the canes and leaves, respectively.

The most destructive diseases of sesame were a leaf curl probably caused by a virus, and a bacterial disease affecting the stems, branches, and leaves. Two leaf fungi attacking this host are an *Oospora* and a *Helminthosporium* provisionally referred to *H. gigasporum* subsp. *javanicum*.

*Armillaria* [*mellea*] was recorded on banana and was very destructive on cassava, the roots of the latter being rendered quite useless. A few perithecia probably of *Mycosphaerella manihotis* [ibid., v, p. 531] were found on angular spots on cassava leaves, mostly along the midribs.

DEIGHTON (F. C.). **Mycological work.**—*Ann. Rept. Agric. Dept. Sierra Leone for the year 1932*, pp. 20–23, 1933.

Towards the end of 1932, Cavendish bananas [*Musa cavendishii*] growing at Njala, Sierra Leone, became widely affected by black-tip (*Helminthosporium torulosum*) [*R.A.M.*, xi, p. 464], infection being followed by a cigar-end rot associated with a *Verticillium* [ibid., x, p. 504]. Leaf blotch of the same host was associated with *H. torulosum* and *Scoletotrichum musae*.

In a test of 14 different varieties of cassava, Mayugbe and Two Cent varieties proved to be very resistant to mosaic [ibid., xii, p. 202] and are being distributed by the Agricultural Department. The leaf fall and die-back of cassava recorded in 1931 [loc. cit.] was ascertained to be a normal response to dry season conditions.

Citrus scab [*Sporotrichum citri*] was observed on the Satsuma orange [*Citrus nobilis* var. *unshiu*] as well as on the hosts previously recorded [loc. cit.].

At Newton many grapefruit trees imported in 1929 were affected by gummosis, 22 out of 25 McCarty and a number of Duncan trees becoming infected. Some imported Genoa lemons at Njala budded on rough lemon [*C. limonia*] were also affected. No attempt was made to isolate the causal organism, but a strain of *Phytophthora parasitica* was isolated in 1929 from a similarly affected sweet orange [ibid., x, p. 81].

Rotting of citrus fruits in the field appeared to be a normal result of wounding by needle pricks or of injury by fruit-piercing moths; the fungi most commonly noted were strains of *Fusarium* and two yeasts, though *Oospora citri-aurantii*, *Gloeosporium*, *Phomopsis*, and *Diplodia* were occasionally isolated.

A leaf disease of obscure etiology affected oil palms [*Elaeis guineensis*] of the Deli type at Njala, starting, apparently, on the young, unopened spear-leaves; the newly expanded pinnae were often stuck together at their distal points and covered with a *Fusarium*, while a *Phyllosticta* was present on the older leaves.

A blossom-drop of avocado associated with a *Botrytis* was commonly present at Njala and in the event of plantations being established is likely to prove serious. When about to open the flowers became covered with the fungus and fell off, whole inflorescences sometimes dropping. *Jatropha podagrica* in the vicinity was similarly affected apparently by the same species. A zonate leaf blotch of avocado was associated with a *Colletotrichum* with sparse setae.

Other records include *Cercospora coffeicola* causing brown eye-spot of coffee berries, *Plasmopara viticola* on the vine, *Phyllosticta batatae* on sweet potato, *Aecidium tubulosum* (African form) on *Solanum incanum*, and the entomogenous fungi *Empusa fresenii* [ibid., xi, p. 640] on *Aphis laburni* on groundnuts and *Aschersonia marginata* Ell. & Ev. (*Hypocrella reineckiana* P. Henn.) on *Pulvinaria* sp. on guava and *Anisophyllea laurina*.

SHEPHERD (E. F. S.). **Botanical Division.**—*Ann. Rept. Mauritius Dept. of Agric. for 1931*, pp. 12–15, 1932.

The incidence of gummosis (*Bacterium vascularum*) and leaf scald (*Bact. albilineans*) stem infection on White Tanna sugar-cane, as revealed by a survey at the mill carriers in Mauritius in 1931, worked out as 5 and 9 per cent., respectively [*R.A.M.*, xi, p. 496]; this was approximately in accord with the ratio given by field observations. A preliminary experiment conducted on the resistant variety D.K. 74 indicated that both diseases are readily spread by means of the cutting knives. A leaf stripe disease formerly thought to be a stage of scald, and to which P.O.J. 2878

and White Tanna appear to be particularly susceptible, is now considered to be the Java 'fourth disease' [ibid., xi, p. 4].

The *Phytophthora* associated with collar rot of tobacco [ibid., xi, p. 496] was identified as a strain of *P. parasitica*. In the section of this report dealing with the work of the tobacco division (pp. 21 to 23) by G. Corbett it is stated that the disease appeared in epidemic form on certain plantations after heavy rains accompanying a cyclone in March. It disappears during cool weather and reappears with the summer rains. A proclamation issued in April, 1931, prohibited the transfer of tobacco seed or young plants from one plantation to another unless certified as unlikely to be infected.

NĚMEC (B.). **Die Wurzelbildung an den bakteriellen Pflanzentumoren.** [Root formation by bacterial plant tumours.]—*Studies Plant Physiol. Lab. Charles Univ. Prague*, iv, 2, 66 pp., 1 fig., 1932. [English summary.]

In connexion with a study of the action of *Bacterium tumefaciens* on callus formation, the writer observed that the strain isolated from apples in the United States (subsequently named *Pseudomonas* [*Bact.*] *rhizogenes*) [*R.A.M.*, xi, p. 561] caused intensive callus production on the cut surface of the roots of chicory (*Cichorium intybus*), while at the same time completely suppressing the ordinarily profuse formation of shoots. In subsequent experiments the inoculated cut surfaces of decapitated epicotyls of horse-chestnut (*Aesculus hippocastanum*) seedlings produced a large, irregular callus on which adventitious buds and roots were formed, though the growth of the buds was very slow. The adventitious roots did not develop on normal callus, and the writer believes they are due to the secretion by the bacterium of some substance stimulating them while simultaneously retarding bud growth.

OKABE (N.). **Bacterial diseases of plants occurring in Formosa I.**—*Journ. Soc. Trop. Agric.*, iv, pp. 470–483, 5 figs., 1932.

The symptoms of the following bacterial diseases of plants in Formosa, Japan, are described, with notes on the morphology, physiology, and taxonomy of the causal organisms, and on the results of inoculation tests: bacterial pustule of soy-bean (probably *Bacterium phaseoli* var. *sojense* [*R.A.M.*, xi, pp. 18, 222, 772] though a close relationship with *Bact. phaseoli* and *Bact. glycines* is also indicated); bacterial leaf spot of castor bean (*Bact. ricini*) [ibid., viii, p. 221]; citrus canker (*Bact.* [*Pseudomonas*] *citri*) [ibid., x, p. 593] affecting 41 local species and varieties [which are listed]; bacterial black spot of radish (*Bact. maculicola*), also attacking several species of *Brassica*, including cauliflower [ibid., xi, pp. 146, 745]; black rot of crucifers (*Bact. campestre*) [*P. campestris*: ibid., xii, p. 425]; and angular leaf spot of cotton (*Bact. malvacearum*) [ibid., xii, p. 439].

OKABE (N.). **Bacterial diseases of plants occurring in Formosa II.**—*Journ. Soc. Trop. Agric.*, v, pp. 26–36, 3 figs., 1933.

Continuing his investigations on the bacterial diseases of plants in Formosa [see preceding abstract], the writer gives detailed

descriptions of a bacterial leaf spot of tomato, caused by *Bacterium tomato* n. sp., and of red stripe of sugar-cane leaves due to *Bact.* (*Phytomonas*) *rubrilineans* [*R.A.M.*, xii, p. 245].

Bacterial leaf spot of tomatoes is characterized by primary infection of the basal part of the plant, gradually extending to the younger leaves near the top. The lesions on the upper surface are at first yellowish-brown and water-soaked, later blackish-brown (paler on the under side), irregularly circular, and 1 to 3 mm. in diameter; at a more advanced stage the centres become sunken and papery with a pale yellowish-green halo (baryta yellow in severe infestations). The spots are often so densely crowded over the leaves as to give a yellow, shrivelled appearance, accompanied by raggedness of the margins and sometimes by distorted growth in the early stages.

The causal organism is a large rod with rounded ends, sometimes slightly curved, occurring singly or in pairs, occasionally in chains, with one to three polar flagella, and measuring 1·8 to 6·8 by 0·69 to 0·97 $\mu$. Pseudozoogloeae are usually produced in liquid cultures. The colonies on beef extract agar are white, opalescent, circular, flat to slightly raised, with a smooth, glistening surface. Gelatine is liquefied, milk coagulated, and casein peptonized; acid is produced from dextrose, saccharose, and lactose, and a feeble diastatic action exerted on potato starch; ammonia is formed; a moderate growth is made in Uschinsky's solution (with bluish fluorescence) but none in Cohn's or Fermi's. The minimum, optimum, and maximum temperatures for development are below 5°, 20° to 25°, and 33° C., respectively, and the thermal death-point is 48°. The organism remains alive for six months on beef extract agar at low temperature, stains with aniline dyes, is Gram-negative, non-acid-fast, and can retain its virulence for more than a year. Desiccation is withstood for 12 but not for 24 hours. Inoculation experiments with water suspensions gave positive results on tomato and eggplant, the latter, however, seldom contracting the disease in a severe form. *Bact. vesicatorium* [ibid., xi, pp. 355, 772, 803, 804] produces closely similar symptoms on the leaves but differs from the new organism in its capacity to attack other organs and also in its cultural characters (yellow colonies, capsulate, no growth in Uschinsky's but some in Fermi's solution, optimum and maximum temperatures for growth 27° to 30° and 40°, respectively).

Red stripe of sugar-cane is characterized by the occurrence on the leaves of long, narrow, deep red or maroon-coloured, longitudinal stripes, 0·15 to 2 mm. wide. The causal organism differs to some extent in pathogenicity and cultural characters from *P. rubrilineans* as originally described from Hawaii. Thus, in the latter country the stripes are reported to extend occasionally down to the leaf sheath, while in severe cases top rot may be a feature of the disease, neither of which manifestations was observed by the writer on Badila (resistant to *P. rubrilineans* in Hawaii) and P.O.J. 2878 canes in Taihoku. Moreover, the Hawaiian organism liquefies gelatine and reduces litmus completely, but scarcely changes the reaction of milk, whereas the Japanese form neither liquefies gelatine nor reduces litmus but

shifts the reaction of milk in the alkaline direction. The Javanese red stripe organism has been referred to *P. rubrilineans* [ibid., ix, p. 679] notwithstanding slight differences from the Hawaiian form and for the present the newly discovered Japanese organism is included under the same binomial.

PELTIER (G. L.). **Physiologic forms of Wheat stem rust in Kansas and Nebraska.**—*Phytopath.*, xxiii, 4, pp. 343–356, 6 maps, 1933.

The writer has continued his studies on the primary sources of wheat stem rust (*Puccinia graminis tritici*) in Kansas and Nebraska [*R.A.M.*, ix, p. 97; xii, p. 360], the present observations on the spread of the fungus and the occurrence of physiologic forms covering the period from 1928–30.

In the majority of cases infected barberry bushes in northern Kansas were found to be spreading *P. g. secalis* to adjacent cereals and susceptible grasses (*Agropyron smithii*, *Hordeum pusillum*, *H. jubatum* [ibid., xii, p. 273], and *Hystrix patula*). In Nebraska only one infected bush was observed spreading *P. g. tritici* prior to the appearance of primary uredosori not directly traceable to barberries. Uredosori were found during the first week in June in Kansas and by the second week in southern Nebraska in 1929 and 1930, appearing somewhat later in 1928. No appreciable loss from wheat stem rust occurred in either State during the three years over which the observations extended.

Five physiologic forms were identified from the Kansas collections, form 36 being predominant and present as primary uredosori, 15, 14, and 38 more sparsely but fairly evenly distributed, while only one collection of 49 was detected in the south-east [cf. ibid., xii, pp. 14, 427]. Form 36 was also the most prevalent in Nebraska, where 34 and 38 were also comparatively common and 56 was isolated from material from the southern part of the State. The available evidence suggests that there is a movement of uredospores from local overwintering centres in the southern States, e.g., Texas, Oklahoma, Missouri, and Arkansas, into Kansas and Nebraska each season. The exact amount and distribution of wind-blown uredospores thus reaching Kansas and Nebraska cannot be accurately determined, since some of the inoculum originates from infected barberries not yet eradicated in these and adjacent States.

STROEDE (W.). **Ueber den Einfluss von Temperatur und Licht auf die Keimung der Uredosporen von Puccinia glumarum f. sp. tritici (Schmidt) Erikss. et Henn.** [On the influence of temperature and light on uredospore germination in *Puccinia glumarum* f. sp. *tritici* (Schmidt) Erikss. et Henn.]—*Phytopath. Zeitschr.*, v, 6, pp. 613–624, 3 graphs, 1933.

In continuation of Stock's investigations [*R.A.M.*, x, p. 587], the writer studied the effect of temperature and light on uredospore germination in yellow rust of wheat (*Puccinia glumarum* f. sp. *tritici*) [ibid., x, p. 714].

The optimum temperature for germination was found to be 11° C., at which point 100 per cent. germination took place within

six hours. All the uredospores germinated also at higher temperatures up to 20°, but the average duration of the process was considerably lengthened (up to 72 hours). The optimum for *P. glumarum* is thus much lower than the corresponding points for the species previously studied [ibid., x, p. 587]. The maximum temperature for germination in *P. glumarum* was found to be 25° as compared with over 30° for the other rusts, while the minimum corresponds with that of *P. secalina* (just above 0°).

Both natural and artificial light retarded the process of germination in *P. glumarum*, which in this respect resembles *P. graminis*. Old spores (8 to 10 days) germinated much more slowly than young ones (2 to 3 days) at temperatures above 16°.

STRAIB (W.). **Über Gelbrostanfälligkeit und -resistenz in den verschiedenen Triticum-Reihen.** [On susceptibility and resistance to yellow rust in the various *Triticum* groups.]—*Zeitschr. für Züchtung*, A, xviii, 2–3, pp. 223–240, 1933.

A fully tabulated account is given of the writer's experiments, at the Brunswick Institute of Agricultural Botany, to determine the reaction to 14 biologic forms of yellow rust (*Puccinia glumarum*) of 290 species and varieties of wheat belonging to 11 groups [*R.A.M.*, xii, p. 273].

In the *monococcum* group marked differences in reaction were observed both among the varieties of *Triticum aegilopoides* and among those of *T. monococcum*. *T. aegilopoides* var. *boeoticum*, for instance, showed a much slighter degree of infection than the vars. *thaoudar* and *zuccariori* of the same species. *T. monococcum* var. *laetissimum* and most strains of var. *vulgare* proved highly susceptible, whereas the vars. *hornemanni* and in particular *flavescens* gave consistent evidence of resistance. *T. dicoccoides* var. *spontaneonigrum* was almost uniformly resistant, while certain biologic forms of *P. glumarum* caused heavy infection on the vars. *fulvovillosum* and *spontaneovillosum*. As a whole, the *dicoccum* group is characterized by a striking lack of uniformity in its response to infection by *P. glumarum*, the different biologic forms of which produce varying results. Most of the representatives of *T. spelta* were susceptible, only one *album* kind known as Emmer aus Tzaribrod showing a high degree of resistance to all biologic forms of the rust. *T. compactum* was also predominantly susceptible, though some varieties were highly resistant to forms 10 to 14 [ibid., xii, p. 272]. The majority of the German winter wheat varieties (*T. spelta* var. *vulgare*) proved immune from, or highly resistant to, forms 11, 12 (Austrian), 13 (Canadian), and 14 (Finnish), while both winter and summer varieties are in general severely attacked by most of the German biologic forms of the rust. Form 9, however, is to some extent exceptional, since it spares a large number of winter wheats while attacking the summer varieties with consistent severity.

The results of these investigations do not support Vavilov's conclusions (*Ann. Acad. Agron. Petrovskoe*, iii, p. 1, 1918) as to the phylogenetic basis of resistance and susceptibility in the different wheat groups. Both resistant and susceptible varieties have been found in each of the groups tested, the reaction of the individual

variety depending rather on the virulence or otherwise of the particular biologic form used than on any inherent predisposition in the wheats. Reaction to yellow rust, therefore, cannot be used as a reliable criterion in the classification and delimitation of wheat species and varieties, and the bearing of this observation on genetic procedure is briefly discussed.

MILAN (A.). **Il numero delle cariossidi sulle spiche di Grano sane e cariate in confronto.** [The numbers of caryopses on healthy and bunted Wheat ears compared.]—*Nuovo Giorn. Bot. Ital.*, N.S., xl, 1, pp. 78–93, 4 pl. (facing p. 182), 2 charts, 1933.

An account is given of the author's further studies conducted in the lower valley of the Po of the effects produced on wheat by bunt attack (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*: *R.A.M.*, xii, p. 209]. The results [which are tabulated and expressed graphically] may very briefly be summarized as follows. In both early and late varieties bunted ears always contain more caryopses than healthy ones at the same stage of growth. When attacked by the mycelium the ovaries become hypertrophied. The average number of caryopses in healthy and bunted ears varies with the date of sowing. Late varieties sown on dates far removed from that best suited to them suffer reduction in fertility; on the other hand, when early varieties are sown too late their fertility increases. It is evident that, particularly in late varieties sown late, the host may become extinct owing to loss of fertility, while the parasite would still be able to survive. Under normal field conditions in the lower Po valley the precocity of some varieties can be so accentuated that grain can be obtained whatever the date of sowing; using such varieties, the fructification of *T. caries* and *T. foetens* can be brought about at any time of the season.

ARNAUD (G.) & GAUDINEAU (Mlle M.). **Sur le traitement de la carie du Blé.** [On the treatment of Wheat bunt.]—*Comptes rendus Acad. d'Agric. de France*, xix, 13, pp. 465–469, 1933.

The salient points in this account of the writers' continued investigations on the control of wheat bunt [*Tilletia caries* and *T. foetens*] in France have already been noticed from another source [*R.A.M.*, xii, p. 429].

FRIEDRICHS (G.). **Die Bestimmung des Bestäubungsgrades trockengebeizten Saatgetreides bei der Lohnbeizkontrolle.** [The determination of the adhesiveness of dusts to treated cereal seed-grain in the supervision of co-operative disinfection plants.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xiii, 4, pp. 25–27, 1933.

Details are given of a colorimetric method of testing disinfectant dusts for their adhesive capacity [*R.A.M.*, xi, p. 502], based on the admixture with the fungicidal substance of a dye which, on slightly moistening the cereal seed-grain, colours the latter to a varying degree according to the amount applied. This method, worked out in Holland by W. B. L. Verhoeven on the suggestion

of A. Winkelmann [ibid., viii, p. 366], has been adapted by the writer with highly satisfactory results in his work as supervisor of the Westphalian co-operative seed-grain disinfection plants [ibid., xi, p. 707].

DJELALOFF (R.). Опыты по головне (**1929–30 и 1930–31 г.г.**). [Experiments on bunt (1929–30 and 1930–31 seasons).]—Pamphlet issued by *Азербайджанский Сел.-Хоз. Инст.* [*Azerbaijan Agric. Inst.*], Baku, 52 pp., 5 graphs, 1932. [English summary. Received July, 1933.]

This is a detailed account of experiments in the 1929–31 seasons in several localities of Azerbaijan [Caspian littoral of the Caucasus] for the purpose of determining the relative efficacy of various seed-grain treatments in the control of wheat bunt (*Tilletia levis*) [*T. foetens*]. The results [which are presented in the form of tables and graphs] showed that all the fungicides tested, with the exception of calcium arsenite dust containing 12·5 per cent. $As_2O_3$, impaired the germinability of the seed and the vigour of the surviving seedlings, the loss of yield entailed being, in most cases, greater than that caused by the disease. Comparative tests showed that spore load is an important factor in the efficacy of the fungicides [*R.A.M.*, xi, p. 289], since with grain contaminated with 0·1 gm. bunt spores per 100 gm., even the weakest preparations gave good control, while at the rate of 1 gm. none was effective except formalin and calcium arsenite dust (72 per cent. $As_2O_3$). The date of sowing also affected the efficacy of the preparations (except formalin), their action both on the seedlings and on the bunt being weakest at the later winter sowings, i.e., when the soil temperature was lowest and its moisture content highest. It also had a bearing on the incidence of the bunt, independently of the fungicides, since seed-grain dusted with the same amount of *T. foetens* spores and sown on the 1st and 15th November and 7th December, gave 71·68, 44·0 and 15·7 per cent. bunt, respectively, in the ensuing crops. Under the local conditions, the best control was obtained with the dust preparation AB (25·74 per cent. CuO), calcium arsenite (12·5 per cent. $As_2O_3$), and chrompik [composition not indicated] at the rate of 0·5 gm. per 100 gm. grain.

Resistance tests in 1930–1 showed that, while no wheat varieties were immune from bunt, the greatest resistance was exhibited by Daghestan-bred lines of all the varieties, as well as by pure lines of the Co-operatorka wheat. There was evidence that the higher resistance of the *durum* wheats, noted by many other workers, is mainly dependent on ecological conditions, since under certain combinations of these factors, these wheats were as susceptible as the *vulgare* varieties. In infection experiments on barley and wheat with *T. pančičii* [ibid., iv, p. 665], this bunt proved to be weakly virulent to three out of ten varieties of barley tested, and gave no infection on wheat.

DJELALOFF (R.). Головня Хлебных злаков в Азербайджане. [Cereal smuts in Azerbaijan.]—Pamphlet issued by *Азербайджанский Иаучно-Исследов. Инст.* [*Azerbaijan Scientific Res.*

*Inst.*], Baku, 33 pp., 1932. [In the Azerbaijan language, with Russian translation, and English summary. Received July, 1933.]

The results of a survey in 1930 for the purpose of determining the distribution and economic importance of cereal smuts in Azerbaijan showed that in that republic wheat suffers most from bunt, the percentage of infection in 1929 having varied from 0·1 to 19·8, with an average of 2·6. Of the two species involved *Tilletia levis* [*T. foetens*] is present all over the country, while *T. tritici* [*T. caries*] occurs in two localities of the Cuba district, to which it was probably introduced with seed-grain from other regions of Russia. Field observations indicated that irrigated wheat suffered less from bunt than that on non-irrigated soil, and that good tillage appeared also to reduce the incidence of the disease. Disinfection in 1929 of 18 per cent. of the total cereal seed-grain involving an expenditure of under 30,000 roubles [nominally £3,000] is estimated to have saved 1,375 tons of the cereals, valued at 137,800 roubles. Loose smut (*Ustilago tritici*) is widespread, but does little damage, the maximum percentage infection observed being 2·4.

Barley is chiefly attacked by covered smut (*U. jenseni*) [*U. hordei* Kellerm. & Swing.], the percentage of infection noted fluctuating from 0·1 to 15·8. Loose smut (*U. hordei* Bref.) [*U. nuda*] is considerably less prevalent, the maximum infection in autumn-sown barley being 6·9 per cent. and in the spring-sown 0·8 per cent. Besides these two smuts, a very slight infection of barley with *U. pančići* [see preceding abstract] was found in a locality of the Cuba district; this is believed to be the first record of this species for Russia. Oats, a minor crop, are attacked by *U. avenae* and *U. levis* [*U. kolleri*], the latter being the more frequent.

Foëx (E.) & Rosella (E.). **Note expérimentale sur l'un des piétins du Blé.** [Experimental note on one of the foot rots of Wheat.]—*Comptes rendus Acad. d'Agric. de France*, xix, 13, pp. 470–474, 1933.

*Cercosporella herpotrichoides* [*R.A.M.*, xii, p. 430] is generally supposed to cause relatively little damage to spring wheat in France as compared with the autumn crop, but as the affected plants are entirely destroyed and disappear it is difficult to estimate the losses from this source, which are probably considerable. In 1930–1 late autumn sowings of Bon Fermier were found to give a superior yield both to those of 1st October and to the spring plantings. Deep sowing (5 to 8 cm.) was found to promote infection by foot rot, wide spacing between the lines (30 cm.) to reduce it. The beneficial effects of spraying with sulphuric acid (9 per cent. for the first application and 12 per cent. for subsequent ones) were found to be only transitory, ceasing with the advent of rainy weather.

Greaney (F. J.) & Machacek (J. E.). **Production of a white fertile saltant of Helminthosporium sativum by means of ultra-violet radiation.**—*Phytopath.*, xxiii, 4, pp. 379–383, 2 figs., 1933.

Ultra-violet irradiation of strains of *Helminthosporium sativum*

isolated from cereals in Canada [see next abstract] produced a decided increase in the frequency of saltation, while in the susceptible strains there was a marked suppression of growth [cf. *R.A.M.*, xii, p. 316]. So far the saltants have remained constant. One irradiated strain of the fungus produced a strongly sporulating, albinistic saltant, the spores and mycelium of which are hyaline, but pale pink in the mass. The mutant was shown by field and greenhouse experiments to be equally virulent with the parent; it was recovered unchanged from the diseased plant parts.

SALLANS (B. J.). **Methods of inoculation of Wheat with Helminthosporium sativum P.K. and B.**—*Scient. Agric.*, xiii, 8, pp. 515–527, 1 fig., 1933. [French summary on p. 542.]

The results of comparative experiments showed that for the purpose of studying the various problems connected with the diseases of wheat caused by *Helminthosporium sativum* in Western Canada [*R.A.M.*, xi, p. 293] the method of inoculation of the seed-grain by soaking in a suspension of the spores of the fungus is the most suitable. Drying the seed-grain afterwards did not affect adversely infection and facilitated extensive experiments by allowing the use of seed drills. The severity of infection thus produced was considerably increased by incubating the treated seed for 18 to 27 hours at 24° C.; this allowed the conidia to germinate on the seed, producing short, much branched germ-tubes, some of which penetrated the epidermis of the pericarp, with the probable result that when the seed was sown, a large amount of mycelium was present around the plumule and coleorhiza as soon as they emerged through the pericarp. Longer periods of incubation were detrimental in that they resulted in the germination of the seed before sowing. The method is capable of standardization by regulating the concentration of the spores in the suspension, the even distribution of moisture on the seed, the temperature, and the length of incubation. The age of the culture from which the spores were derived was shown to be an important factor, two-week-old cultures having been found to be the most suitable by the author.

Inoculation of the soil with cultures of *H. sativum* on mashes prepared from grains or parts thereof was found to be effective but unsatisfactory, in that the addition of such uninoculated media to the controls was shown to result in severe injury to the seedlings.

BROADFOOT (W. C.) & ROBERTSON (H. T.). **Pseudo-black chaff of Reward Wheat.**—*Scient. Agric.*, xiii, 8, pp. 512–514, 1 pl., 1933. [French summary on p. 542.]

A brief description is given of a discoloration, simulating black chaff (*Bacterium translucens undulosum*) [*R.A.M.*, xi, p. 434; xii, p. 13] of wheat, which has been observed every year since 1929 in Alberta on Reward wheat, and occasionally also on Marquis. The discoloration was confined almost entirely to the glumes and the rachis, especially in those parts which were exposed to light. Histological and cultural studies showed that the condition is not due to the activity of parasitic organisms, but is probably due to

the fact that some strains of Reward wheat still carry colour factors which, under suitable light conditions, produce the pigmented areas.

Reed (G. M.). **Reports on research for 1932. Plant pathology.**—*Twenty-second Ann. Rept. Brooklyn Bot. Gard.*, 1932 (*Brooklyn Bot. Gard. Record*, xxii, 2), pp. 53–57, 1933.

Of 88 $F_3$ progenies of Hybrid 16 (Gothland × Victor) inoculated with covered smut of oats [*Ustilago kolleri*: *R.A.M.*, xi, p. 506], 32 were classified as resistant (no infection), 44 segregating (under 50 per cent. smut), and 12 susceptible (up to 100 per cent. diseased). As usual, the Gothland parent remained quite free from covered smut, while Victor showed almost 100 per cent. infection. Both these varieties are highly susceptible to loose smut [*U. avenae*], and out of 28 $F_3$ progenies (633 plants) inoculated with this fungus, 603 (95·2 per cent.) contracted infection. Of 40 $F_3$ progenies of Hybrid 18 (susceptible Silvermine × resistant Black Mesdag) inoculated with loose smut, 15 were resistant, 18 segregating, and 7 susceptible, the corresponding figures for 42 inoculated with covered smut being 15, 21, and 6, respectively. Of 71 $F_3$ progenies of Hybrids 34, 35, and 36 (susceptible Early Champion × Black Mesdag) inoculated with *U. avenae*, 17 were resistant, 31 segregating, and 23 susceptible, the corresponding figures for the 72 inoculated with *U. kolleri* being 21, 40, and 11, respectively.

Nearly all the 286 $F_4$ progenies of Hybrids 17, 18, 33 (Early Champion × Black Mesdag), 34, 35, and 36 were pure resistants to both smuts, four of the five exceptions (descendants of 36) showing less than 50 per cent. infection and one more.

Of 98 $F_3$ progenies of Hybrids 29, 30, 31, and 32 (Fulghum × Black Mesdag) inoculated with a strain of *U. avenae* to which the first-named parent is highly susceptible, 27 were resistant, 47 segregating, and 24 susceptible. Evidence is available that the strain of loose smut occurring on Fulghum is differentiated into more than one race.

In general, the maximum percentages of infection by the oat smuts are obtained at about 20° C., little or none occurring on plants germinated at 30°; one race of *U. kolleri*, however, caused a fairly high incidence of infection at the latter temperature.

Somers (L. A.). **Bacterial wilt or Stewart's disease of sweet Corn.**—*Trans. Illinois State Hort. Soc.*, lxvi (*1932*), pp. 336–347, 1933.

Extremely heavy damage was caused in 1931 and 1932 in Illinois by the bacterial wilt of maize [*Aplanobacter stewarti*: *R.A.M.*, xii, p. 364]. In the latter year nearly every plant in each of the 66 fields inspected by B. Koehler and J. R. Holbert showed the presence of leaf blight, the loss of green leaf area ranging from a trace to 50 per cent. with an average of 16·6 per cent. Stalks with yellow vascular bundles were also found in nearly every field examined, the incidence being as high as 85 per cent. in one, with an average of 6·2 for all. In some cases between 45 and 47 per cent. of the plants were prematurely killed, either by bacterial

wilt alone or as a result of secondary infection by *Diplodia* [*zeae*]. In some plants the bacterial exudation from pores on the inner husks was so profuse that the kernels were literally covered. In addition to the usual cultural measures (including crop rotation) and seed treatment, the Smith selections, especially Golden Cross Bantam, and some top crosses from Purdue 39 and 51 should be extensively tested for resistance.

NĚMEC (B.). **Die Brandbeulen von Ustilago maydis.** [The smut galls of *Ustilago maydis*.]—*Studies Plant Physiol. Lab. Charles Univ. Prague*, iv, 2, 22 pp., 10 figs., 1932. [English summary.]

The swellings produced by *Ustilago maydis* [*U. zeae*: *R.A.M.*, xii, p. 365] were shown, by the writer's examination of fixed material, to arise exogenously and start by the enlargement and subsequent division of both epidermal and cortical stem cells. The parenchymatous cells of the xylem and phloem of the outer longitudinal vascular bundles may also participate in the development of the gall, while a few outer cells of the sclerenchyma strands may be involved. The gall consists of the epidermis, a parenchymatous ground tissue, and an irregular net of bundles, mostly phloem bundles.

The parenchymatous ground tissue is substantially composed of diploid cells, among which are many tetraploid and some giant polyploid cells with one large or two or more smaller nuclei. Different stages of nuclear fusion have been observed in many cells, this process and repeated mitosis resulting in the formation of the large polyploid cells.

During the process of sporulation the galls cease to develop further and ultimately die. No correlation exists between polyploidy and the etiology of the tumours, the former resulting from abnormal conditions within the latter.

BRESSMAN (E. N.). **Experiments with head smut of Corn in western Oregon.**—*Phytopath.*, xxiii, 4, pp. 396–403, 1 fig., 1933.

Head smut of maize (*Sorosporium reilianum*) [*R.A.M.*, xii, p. 165] has been observed in a destructive form in parts of western Oregon, affecting 90 per cent. of the crop near Salem in 1930 and causing heavy damage.

Greenhouse experiments in 1931 showed that the disease is transmissible to some extent by seed-borne spores, infection by which was found to be preventable by a number of chemical treatments, including 50 per cent. copper carbonate dust, landplaster (powdered gypsum), and powdered paraformaldehyde. In field trials, however, none of the treatments used gave effective protection against contamination through the soil; even formaldehyde solution, applied to the seed and the soil, was ineffective. The sole indication of infection in 11 per cent. of the diseased plants in the field trials and 17 per cent. in the greenhouse experiments was the abnormal vegetative proliferation of the ears.

The local strain of *S. reilianum* was not transmissible in greenhouse tests to six varieties of sorghum [ibid., vi, p. 548] and it is

considered safe therefore to use sorghum in rotation on infected land. Of the six maize varieties, namely, Minnesota No. 13, 'Schucking', Golden Glow, McKay Dent, Putnam Red, and African White, planted without treatment in smut-contaminated soil at Salem, none showed a marked degree of resistance.

VOORHEES (R. K.). **Gibberella moniliformis on Corn.**—*Phytopath.*, xxiii, 4, pp. 368–378, 3 figs., 1933.

*Gibberella moniliformis* [*R.A.M.*, xi, pp. 399, 569] is stated to be one of the most prevalent maize seed parasites in Florida, where the annual reduction in yield from this source is estimated at 5 per cent. of the crop. The symptoms caused by the fungus are outlined and the morphological characters of the imperfect and perfect stages described.

The perithecial stage was found occurring naturally on maize and was produced on standard media (of which potato-dextrose agar was the best) in pure culture by pairing multisporous cultures derived from macro- and microconidia, and also by inoculating maize stalks with multisporous cultures singly and in combination. Mono-ascospore cultures isolated from maize leaf sheaths produced perithecia in abundance.

The microconidia of *G. moniliformis* germinated in water at a temperature range between 11° and 35° C., the optimum being close to 30°. On potato-dextrose agar the minimum, optimum, and maximum temperatures for mycelial growth were found to be 10° to 14°, 30°, and 35° to 39°, respectively.

In modified rag doll germination tests of seed ears of the Whatley, Tisdale, Cuban Yellow Flint, and Powell's White Dent maize varieties, *G. moniliformis* weakened or killed the kernels in some cases, while in others no effects were noticeable. The roots and mesocotyls of maize seedlings grown in sterilized soil inoculated with the fungus were retarded in development or killed. In plot tests conducted in 1929–30 the yields from seed infected by *G. moniliformis* were less than those from healthy seed in all but one test, the maximum difference in favour of healthy seed being 5·5 bushels.

HIRATA (E.) & TAKENOUTI (H.). **Studies on the morphological and physiological characters of Sclerospora graminicola on Setaria italica.**—*Ann. Agric. Exper. Stat., Gov.-Gen. Chosen*, vi, pp. 157–200, 2 pl., 1932. (Japanese.) [Abs. in *Japanese Journ. of Botany*, vi, 3, p. (66), 1933.]

The mycelium of *Sclerospora graminicola* runs intercellularly through the tissues of *Setaria italica* [*R.A.M.*, xii, p. 433], seldom emerging through the stomata. Each conidium produces 2 to 3 biciliate zoospores while the oospores germinate by a single germ-tube. Conidiophores and conidia develop constantly as long as the leaf surface is wet and the temperature fluctuates between 12·5° and 27° C. The germination of conidia and zoospores takes place when these organs are immersed in water and receive an adequate supply of air within the temperature limits of 12·5° to 29°, the process being unaffected by light. The oospores germinate under

similar conditions between 12·5° and 35°; in a dormant state they may retain their viability for eight months.

SAVASTANO (G.). **Gli sviluppi più recenti delle ricerche sulle malattie degli Agrumi in Italia.** [Recent developments in the study of Citrus diseases in Italy.]—*Italia Agric.*, lxx, pp. 343–350, 1933. [Abs. in *Hort. Abstracts*, Imper. Bureau of Fruit Production, iii, 2, p. 82, 1933.]

The more important diseases of citrus in Italy are discussed in some detail, including root rot (*Phytophthora citrophthora* and *P. parasitica*) [*R.A.M.*, xii, p. 281] and 'mal secco' (*Deuterophoma tracheiphila*) [ibid., xii, p. 214]. For the control of the latter disorder, Prof. Petri recommends that lemons replanted in infected zones should be double worked on sour orange [*Citrus aurantium* var. *bigaradia*] with mandarin, which is resistant, as the middle stock. The use of the resistant Interdonato lemon variety is also advised. Legislation is in force to prevent the entry into Italy of *Bacterium* [*Pseudomonas*] *citri*, *Corticium salmonicolor*, *Sphaeropsis tumefaciens* [ibid., xi, pp. 283, 625], and *Gloeosporium limetticolum*.

NELSON (R.). **Some storage and transportational diseases of Citrus fruits apparently due to suboxidation.**—*Journ. Agric. Res.*, xlvi, 8, pp. 695–713, 6 pl., 1933.

The author states that the results of his studies [details of which are given] showed that the surface blemishes of citrus fruits described by previous workers under the names of cold storage spot or pox of grapefruits and oranges [*R.A.M.*, v, p. 735; x, p. 80], and brown spot [ibid., v, p. 735] and brown stain (Thompson, Putterill, & Hobson, *S. Africa Dept. Agric. Bull.*, 1, 1922) of navel oranges are caused by a breakdown of the rind tissues following storage under conditions of poor ventilation or in temperatures low enough to inhibit normal respiratory functions of the fruit.

Typical symptoms of cold storage spot and brown spot were experimentally produced by keeping susceptible fruits in a nitrogen atmosphere for four to ten days, and also in atmospheres of various composition; movement of the atmosphere in the containers without renewal was not effective in preventing their development. Analogous symptoms were also obtained at temperatures between 32° and 42° F. even when there was a sufficiency of oxygen, the susceptibility of the oranges and grapefruits varying with their degree of maturity, green fruits usually being the more susceptible. Finally, lesions resembling those of storage spot and brown spot were produced on oranges and grapefruits that were exposed to the vapours of acetaldehyde, acetic acid, or of a mixture of these substances, the degree of injury also depending on the maturity of the fruit. Both spots appear to arise from injuries to the parenchyma cells surrounding the oil vesicles, and the effect of acetaldehyde and fruit esters on the fruits suggests that some substance having a similar action may be involved in the causation or the accentuation of the injury following storage at low temperatures. Although in most cases oiled wrappers did not decrease the

incidence of either spot on grapefruits and oranges, in a few cases they appeared to have a beneficial effect.

Brown stain is a surface blemish of oranges, occurring on fruit in storage. The disease presents many similarities to apple scald and, except in severe cases, there is no marked depression as occurs in brown spot and storage spot. Injury closely resembling brown stain was produced on navel oranges by exposure to dilute vapours of certain chemicals, among which citral was particularly effective, and also with various acetates which cause scald-like effects on apples.

DEY (P. K.). **Studies in the physiology of the appressorium of Colletotrichum gloeosporioides.**—*Ann. of Botany*, xlvii, 186, pp. 305–312, 1 pl., 1933.

From a study of the formation and function of the appressorium in *Colletotrichum gloeosporioides* on *Citrus medica* var. *acida* the author found that the fungus infects the young leaves through a fine infection hypha produced from the surface of the appressorium in contact with the leaf cuticle. The latter is thought to be pierced mechanically in consequence of the continuous and increasing pressure exerted by the infection hypha [cf. *R.A.M.*, vii, p. 258], a mechanism comparable with that of *C. lindemuthianum* (*Ann. of Botany*, xxxiii, p. 305, 1919). There was evidence that the formation of the infection hypha is stimulated by the diffusion of nutrient substances through the uninjured cuticle and it was further shown that the appressoria of *C. gloeosporioides* do not withstand drying.

BUTLER (E. J.). **Cotton diseases.**—*Empire Cotton Growing Review*, x, 2, pp. 91–99, 1933.

Short, popular notes are given on the geographical distribution, symptoms, causal organisms, losses caused by, and control of the following major diseases of cotton, viz., root rot (*Phymatotrichum omnivorum*) [*R.A.M.*, xii, p. 287], wilt (*Fusarium vasinfectum*, *F.* spp., and *Verticillium albo-atrum*) [ibid., xi, pp. 513, 514], blackarm (*Bacterium malvacearum*) [ibid., xii, pp. 439, 507], anthracnose (*Glomerella gossypii*) [ibid., xi, p. 638], sore shin due to *Rhizoctonia* (*Corticium*) *solani* [loc. cit.], and stigmatomycosis due to one or other of *Nematospora coryli* [ibid., xii, p. 438], *N. gossypii* [loc. cit.], *N. nagpuri* [ibid., x, p. 101], *Spermophthora gossypii* [ibid., xi, p. 606], and *Eremothecium cymbalariae* [cf. ibid., viii, p. 485]. Several minor or less widely distributed diseases are also briefly referred to.

**Annual Report of the Indian Central Cotton Committee, Bombay, for the year ending 31st August 1932.**—136 pp., 1933.

The following references of phytopathological interest occur in this report. The seed of the Jayawant cotton variety, a cross between Dharwar 1 and 2 which combines productivity with resistance to wilt (*Fusarium vasinfectum*) [*R.A.M.*, xii, p. 508], is being distributed through the agency of the Central Committee and is already in cultivation over an area of nearly 140,000 acres. The Dharwar wilt scheme, inaugurated in 1923 to check the

spread of infection on local cottons, was terminated in 1932. During the period of its activity, the following important facts were elicited by researches carried out under the wilt scheme. *F. vasinfectum* consists of a number of physiologic forms. The temperature range of the fungus on agar was found to extend from 18° to 40° C. The disease is most severe at a soil temperature of 20° to 27°, decreasing at 28° to 31° and being completely arrested at 32° [ibid., xi, p. 781]. Infection is carried by the seed.

In the Central Provinces the Bani E.B. 31 variety has again given satisfactory results, while a new strain of [*Gossypium neglectum*] *verum* 438 is also very promising—even more so than the resistant 262.

In Sind all the Egyptian varieties appear to suffer from 'red leaf' disease.

In August, 1932, a scheme for the investigation of root rot [ibid., xi, p. 453] in the Punjab was sanctioned for a period of three years. The disease affects both American and local cottons, mainly in the canal-irrigated tracts, causing an estimated annual damage of Rs. 15,75,000 [£118,125]. A species of *Fusarium* has been found to occur in the diseased plants. Infection usually starts in the last week of June and continues until the middle of September, spreading in a circle among the healthy plants and causing rapid desiccation. A similar scheme was initiated in February, 1932, for two years in Baroda.

RYBERG (O.). **Cordiceps militaris (L.) Link. Några bidrag till kännedomen om dess förekomst och värddjur.** [*Cordyceps militaris* (L.) Link. Some contributions to the knowledge of its distribution and insect hosts.]—*Bot. Notiser, 1933,* 1–3, pp. 417–420, 1933.

The writer records the detection of *Cordyceps militaris* in six more localities of Sweden, bringing the total for the country to 15 [*R.A.M.*, ii, p. 76]; possibly the fungus may be more widespread than these figures indicate. In 1927 it was reported from Denmark in fair numbers on *Phalera bucephala,* also a common host of the fungus in Sweden. Some economic importance may possibly attach to its occurrence on *P. bucephala,* as this polyphagous pest causes heavy damage in orchards and plantations.

Three additional species of *Cordyceps* have recently been found in Sweden, namely, *C. cinerea* on a Carabid larva, *C. clavulata* on a Coccid (both new records for the country), and *C. sphingium* on a Noctuid.

BERGER (E. W.). **The latest concerning natural enemies of Citrus insects.**—Reprinted from *Proc. Florida State Hort. Soc., 1932,* 4 pp., 1932. [Abs. in *Rev. Appl. Entomol.*, Ser. A., xxi, 6, pp. 289–290, 1933.]

In the part of this paper dealing with the fungal parasites of the insect pests of citrus trees in Florida [*R.A.M.*, vi, p. 419] the author mentions 16 species of entomogenous fungi, the use of which in the control of the insects is briefly discussed. Periods of moisture and warmth are important factors in success and heavy cover crops assist considerably in conserving the degree of moisture

required. It is calculated that the use of *Aschersonia aleyrodis* [loc. cit.] alone for combating whiteflies effects an annual saving to the State of about £530,000, by doing away with the necessity of at least one application of an oil spray.

SHREWSBURY (J. F. D.). **Rhinosporidiosis.**—*Journ. of Path. & Bact.*, xxxvi, 3, pp. 431–434, 4 pl., 1933.

A brief account is given of the history of rhinosporidiosis caused by *Rhinosporidium seeberi* [*R.A.M.*, xi, p. 641], with a summary of the life-cycle of the causal organism based on Ashworth's observations [ibid., iii, p. 153]. Attention is directed to the early appearance, regularity of growth, and uniform size of the spherules (regarded by Ashworth as proteinaceous particles) in the spores. Attempts to culture *R. seeberi* from material obtained from Calcutta failed. The study of stained sections from the tumours confirmed Ashworth's observations in most particulars, but an earlier stage of the parasite is apparently represented than any figured in his paper.

AYYAR (V. K.). **Rhinosporidiosis in equines.**—*Indian Journ. Vet. Sci. and Animal Husb.*, xi, pp. 49–52, 11 figs., 1932. [Abs. in *Veterinary Bull.*, iii, 4, p. 182, 1933.]

The author describes a case of rhinosporidiosis [*Rhinosporidium* (?) *seeberi*: *R.A.M.*, ix, p. 242 and preceding abstract] in a pony, recurring after surgical removal of a slightly papillomatous, tumour-like nodule on the anterior part of the septum nasi. The tissue contained sporangia in various stages of development. The infection occurred in a locality where cattle had also been attacked.

AICHELBURG (U.). **Osservazioni sulle proprietà biochimiche di alcune specie di Monilie.** [Observations on the biochemical properties of some species of *Monilia*.]—*Boll. Ist. Sieroterapico Milan.*, xi, 9, pp. 577–584, 1932. [Abs. in *Bull. Inst. Pasteur*, xxxi, 11, p. 519, 1933.]

The results of the writer's studies on the biochemical properties, including action on carbohydrates, serum, gelatine, and milk, of *Monilia* [*Candida*] *krusei* [*R.A.M.*, xii, p. 371], *M. pseudotropicalis*, *M.* [*C.*] *macedoniensis*, *M. guilliermondi*, *M.* [*C.*] *pinoyi*, and *M.* [*C.*] *metalondinensis* [ibid., xi, p. 373], are stated to confirm those obtained by Castellani and his collaborators [cf. ibid., viii, p. 574]. These methods of identification may therefore be recommended as both simple and reliable, provided the strains are investigated as soon as possible after isolation.

CERUTTI (P.). **Concentrazione idrogenionica e sviluppo degli ifomiceti patogeni: ricerche sperimentale e cliniche.** [Hydrogen-ion concentration and development of some pathogenic Hyphomycetes: experimental and clinical studies.]—*Pathologica*, xxv, 495, pp. 32–37, 1933. [German and English summaries.]

On Sabouraud's agar *Trichophyton gypseum* gave an alkaline reaction throughout the period of cultivation (two months), whereas

*Achorion schoenleini*, *Sporotrichum gougeroti*, and *S. schenckii* [*R.A.M.*, xii, p. 291] started with an acid reaction which slowly veered towards alkalinity.

In six cases of pityriasis versicolor [*Malassezia furfur*: ibid., xii, p. 511] a slight diminution of the acidity of the superficial cutaneous strata was observed.

Bloch (B.). **100 Jahre Dermatomykosenforschung.** [100 years of research on dermatomycosis.]—*Schweiz. Med. Wochenschr.*, lxiii, 17, pp. 404–408, 1933.

The writer traces the history of research on the dermatomycoses during the past hundred years, touching on the discoveries of Schoenlein, Audouin, Gruby, Sabouraud, and other leaders in this branch of medical science, and elaborating his own theories (based on experimental studies in collaboration with J. Jadassohn) on various problems of allergy.

Wieder (L. M.). **Modern methods in diagnosis and treatment of the common fungous diseases of the skin.**—*Wisconsin Med. Journ.*, xxxii, 4, pp. 235–241, 1933.

In this paper the writer reviews the clinical knowledge of ringworm diseases, the dissemination of which is stated to have increased rapidly in the last decade. Laboratory aids in diagnosis are given and clinical aspects of allergy and the role of *Monilia* and allied organisms in skin disorders are discussed. The large number of asymptomatic cases and carriers of ringworm is indicated by a recent investigation of 1,000 dispensary patients which disclosed pathogenic fungi in toe scrapings in 51 per cent. [*R.A.M.*, x, p. 596; xii, p. 508], of whom only 4 per cent. came in primarily for ringworm.

Burnier & Duché [J.]. **Un cas d'épidermomycose due à Trichophyton rubidum.** [A case of epidermomycosis due to *Trichophyton rubidum*.]—*Bull. Soc. Franç. de Dermatol., 1933,* 4, pp. 379–380, 1933.

Clinical details are given of an erythemato-squamous epidermomycosis of the thighs and legs in a female patient, who contracted the disorder during a stay in the Cameroons. The fungus isolated from the squamae was characterized by a downy, white colony with a red edge and septate hyphae 3 to 4 $\mu$ in diameter, and therefore agrees with *Trichophyton rubidum* Priestley, hitherto reported only from Asia and Oceania. In an unpublished article Ota divides *T. rubrum* [*R.A.M.*, xii, p. 509] into four categories according to the mode of pigmentation, viz., red mycelium with or without diffused pigment, and white mycelium with or without diffused pigment. On this basis the fungus under observation would belong to the third of these groups. Morphologically, however, it presents the characters of an *Epidermophyton*, the spindles resembling those of *E. inguinale* [*E. floccosum*: loc. cit.], from which it differs, however, in the site of its occurrence on the body.

DEACON (G. E.). **Some effects of Botrytis cinerea on Roses.**—*Trans. Brit. Mycol. Soc.*, xvii, 4, pp. 331–333, 1 pl., 1933.

In recent years die-back in roses has increased considerably in English nurseries and private gardens. The author isolated *Botrytis cinerea* from affected wood, and inoculations resulted in the production of severe die-back in several varieties of roses, even when the plant was beginning active growth. The development of the disease appeared to be greatly influenced by the degree of humidity of the ambient air. On the removal of all infected parts and after being placed under healthy conditions, severely diseased plants recovered from the infection.

MÖHRING (K.). **Die verschiedene Widerstandsfähigkeit von Rosensorten gegen den Sternrusstau.** [The varying capacity of Rose varieties for resistance to star sooty mould.]—*Gartenwelt*, xxxvi, pp. 698–699, 1932. [Abs. in *Zentralbl. für Bakt.*, Ab. 2, lxxxviii, 13–16, pp. 349–350, 1933.]

Garden roses are stated to be liable to excessively heavy damage in Germany from the attacks of *Marssonina* [*Diplocarpon*] *rosae* [*R.A.M.*, xii, p. 223], especially during periods of profuse dew formation in August and September. Observations made on varieties near Mansfeld [Saxony] showed 33 to be immune, but the data obtained are not necessarily applicable to other districts, the Juliet variety, for instance, being only moderately susceptible at Mansfeld but highly so elsewhere.

PAPE (H.). **Mosaikkrankheit an Glieder-, Blatt- und Rutenkakteen.** [Mosaic disease of joint-, leaf-, and twig Cactaceae.]—*Gartenwelt*, xxxvi, pp. 707–708, 731–732, 3 figs., 1932. [Abs. in *Zentralbl. für Bakt.*, Ab. 2, lxxxviii, 13–16, p. 349, 1933.]

The following cactus varieties are liable in Germany to infection by mosaic manifested by the development of pale green, ill-defined, irregular, somewhat sunken spots, accompanied by dwarfing and malformation of the stem internodes: *Epiphyllum truncatum* (Deutsche Kaiserin), *E. harrisonii*, *E. hybridum rubrum*, Meteor, President Grevy, *E. rosa amabilis*, *E. salmoneum*, Vesuvius, *E. violaceum superbum*, *E. bridgesii*, *Phyllocactus gaertneri* var. *mackoyanus*, and *Rhipsalis rosea*. A virus is assumed to be the cause of the disease, which must be combated by the exclusion of infected plants from the propagating houses, and the control of possible insect vectors.

ZELLE (M. A.). Болезни Подсолнечника. [Sunflower diseases.]—*Всесоюз. Госуд. Объединение по борьбе с вредителями и болезнями в Сельском и Лесном Хоз.* [*Pan-Soviet State Assoc. Control of Pests and Diseases in Agric. and Sylvic.*], Leningrad, *Publ.* 6, 32 pp., 8 figs., 1932. [Received June, 1933.]

This is a small booklet on the principal diseases of sunflower [*Helianthus annuus*] in Russia, chiefly intended for local phytopathologists. In addition to brief descriptions of the diseases, it contains directions for recording field observations, and a few

recommendations for control. The fungal diseases dealt with are white rot (*Sclerotinia libertiana*) [*S. sclerotiorum*: *R.A.M.*, xi, p. 651], dry rot of the inflorescence (*Rhizopus nodosus*) [cf. ibid., xi, p. 282], wilt (*Verticillium dahliae*), rust (*Puccinia helianthi*) [ibid., viii, p. 791], grey mould (*Botrytis* sp.) [ibid., v, p. 701], dry brown rot of the inflorescence (*Fusarium* sp.); powdery mildew (*Erysiphe cichoracearum*) [ibid., vii, p. 621], downy mildew (*Plasmopara halstedii*) [ibid., viii, p. 579], and leaf spot (*Septoria helianthi*) [ibid., iv, p. 417]. Descriptions are also given of three serious leaf spots, the causes of which have not yet been established, namely, a brown, concentric spotting, a black spotting of various sizes and shapes, and a yellow, aucuba-like spotting; all three affections result either in a severe stunting or death of the plants affected.

Oettingen (H. v.). **Das Auftreten der Knaulgrasbakteriose in Deutschland.** [The occurrence of bacteriosis of Cock's-foot grass in Germany.]—*Mitt. Ver. Förderung der Moorkult. im Deutschen Reiche*, l, 9–10, pp. 107–108, 1932.

Attention is drawn to the serious nature of the recent epidemics of bacteriosis (*Aplanobacter rathayi*) of cock's-foot grass [*Dactylis glomerata*] in the Mark Brandenburg, Germany [*R.A.M.*, xii, p. 294]. The total annual value of the German crop of *D. glomerata* approximates to M. 1,000,000, so that systematic investigations on the disease are considered thoroughly justifiable.

Shortly after the development of the new spring growth, bare patches are noticeable in the stand, or the grass remains short and tillers irregularly if at all. The basal internodes fail to attain their full length, with the result that the floral shoots are also stunted and distortions of the leaves and leaf sheaths become apparent. About the middle of May the plants begin to show a yellow, slimy coating which is particularly conspicuous over the panicles. The flowers are united by the sticky exudate into a viscous mass of waxy consistency, bright yellow in dry weather and brownish-green under damp conditions. The slimy mass destroys all the organs with which it comes into contact, and may be so profuse as to cover the surrounding soil. Under favourable conditions the affected plants may show partial recovery, but they invariably yield diseased seed whereby the causal organism is disseminated. Stringent precautions should be taken regarding the use of clean seed, the early mowing and breaking up of infected fields, and bi- to triennial crop rotation.

Solunskaya (Mme N.). **Ueber bakterielle Erkrankung der Gefässe bei mehrjährigen Futterleguminosen als Ursache vorzeitigen Absterbens ihres Wurzelsystems.** [On a bacterial disease of the vessels in perennial fodder Leguminosae as the cause of premature dying-off of their root system.]—*Naučn. Zap. Eksper. Inst. Sacharn. Promyšl.*, ix, p. 141, 1932. (Russian.) [Abs. in *Neuheiten auf dem Geb. des Pflanzensch.*, xxvi, 3, p. 55, 1933.]

*Aplanobacter insidiosum* enters the vessels of clover, lucerne, sainfoin [*Onobrychis viciaefolia*], and other legumes through frost

cracks in the epidermis, as well as in the course of mowing operations. Under Russian conditions the bacteria are most numerous in the late summer and in the younger vessels [*R.A.M.*, xii, p. 22]. The infected plants secrete a resinous substance in the vessels, leading to the obstruction of the latter. The diseased plants gradually die off, clover generally in the first year of infection and the others in the second. The sole means of combating the disease lies in the cultivation of the northern frost-resistant varieties.

**Directions for spraying fruit in Illinois.**—*Trans. Illinois State Hort. Soc.*, lxvi (*1932*), pp. 49–80, 2 figs., 1 map, 1933.

Spraying schedules, drawn up by the Department of Horticulture and the Natural History Survey and supplemented by explanatory notes, are given for the control of insect pests and fungous diseases of apples, pears, peaches, cherries, plums, grapes, and other fruits in Illinois. Directions are given for the preparation and mixing of sprays and dusts.

ANDERSON (H. W.). **Results of disease control in 1932.**—*Trans. Illinois State Hort. Soc.*, lxvi (*1932*), pp. 175–200, 6 graphs, 1933.

As in previous experiments, flotation dry wettable sulphur and flotation paste [see below, p. 577] gave equally good control of apple scab [*Venturia inaequalis*] and blotch [*Phyllosticta solitaria*] with lime-sulphur 2 in 100 [*R.A.M.*, xi, p. 520], a spray which is responsible for serious injury to the trees in some seasons. Four applications were generally given, viz., (1) pre-bloom, 14th to 15th April, (2) calyx, 5th to 10th May, (3) one week after petal fall, 12th to 14th May, and (4) three weeks after petal fall, 27th to 30th May. The best results with scab were obtained where flotation sulphur was used at the rate of 10 lb. per 100 galls. water at all four applications, but since the outcome was almost equally satisfactory with 7 lb. at the calyx and 5 lb. at each of the subsequent sprays, the latter concentrations may be recommended. A full bloom spray of 5 in 100 was found to be of considerable value in the reduction of foliage infection in cool, wet weather, when the calyx application may be delayed. Satisfactory early blotch control was obtained where the concentration was maintained at 10 lb. per 100 galls. through the three weeks applications.

In a lime-lead arsenate combination the latter appears to be the chief fungicidal agent. All plots which received lime-sulphur showed from moderate to severe injury whereas those receiving flotation sulphur were completely uninjured or in a few cases very lightly damaged [ibid., xii, p. 29]. During the five years in which detailed investigations (now to be discontinued) of the latter product have been made by the writer in Illinois, both the paste and the dry wettable flotation sulphur have undergone a steady improvement as regards physical properties and uniformity. The dry wettable sulphur (10–7–5–5 lb. applications, respectively) costs 10 to 15 cents. per tree per season more than lime-sulphur, but as a rule this extra outlay will, in the writer's opinion, be sufficiently remunerative to justify it. Among the diseases amenable to con-

trol by flotation sulphur, besides apple scab and blotch, are cherry leaf spot [*Coccomyces hiemalis*], gooseberry anthracnose [*Pseudopeziza ribis*], rose mildew [*Sphaerotheca pannosa*] and black spot [*Diplocarpon rosae*], peach brown rot [*Sclerotinia americana*], and peach scab [*Cladosporium carpophilum*].

DAS GUPTA (S. N.). **Studies in the genera Cytosporina, Phomopsis, and Diaporthe. IV. On the pathogenicity of certain strains of Phomopsis and Diaporthe.**—*Ann. of Botany*, xlvii, 186, pp. 385–400, 5 diags., 1933.

The results [given largely in the form of tables and graphs] of continued studies of the relative attacking power on apples of the species of *Diaporthe* and *Phomopsis* enumerated in a previous communication [*R.A.M.*, ix, p. 658], together with a few others, showed that none of the fungi tested differed significantly in its activity from the *Cytosporina ludibunda* saltants [ibid., xii, p. 377] in both Bramley's Seedling and Worcester Pearmain apples. While the strains of *D. perniciosa* exhibited wide variations in their rate of invasion (more pronounced in Bramley's Seedling than in Worcester Pearmain), the series tended to run parallel to the variations found in *C. ludibunda*, and while in Worcester Pearmains the invasion value for *P. coneglanensis* (0·1143 cm. per day) was higher than that (0·0860) for the $CA_4$ saltant of *C. ludibunda*, the most active of the saltants, the difference was shown to be statistically non-significant.

Attempts to arrange the strains of the fungi in groups were somewhat unsatisfactory, inasmuch as while certain forms, e.g., *D. binoculata* and *D. arctii*, were consistently either medium or weak, and *P. coneglanensis* was always very active, the remainder varied greatly in rate of attack from variety to variety; the age of the apples also appeared to affect the rate of invasion of the individual strains.

From the results obtained the author concludes that *C. ludibunda* cannot be distinguished from the species of *Phomopsis* and *Diaporthe* studied by its power of attack on apples, this similarity between the organisms agreeing with that observed in earlier cultural work with these fungi [ibid., ix, p. 547].

TILLER (L. W.) & CHITTENDEN (E.). **Relation of storage temperature to the overseas carriage of some further varieties of New Zealand export Apples. Report on special work undertaken by the Cawthron Institute, 1930 and 1931.**—*New Zealand Journ. of Sci. & Techn.*, xiv, 4, pp. 241–251; 5, pp. 288–297, 1933.

In continuation of previous investigations on the optimum storage temperature for certain New Zealand export apple varieties [*R.A.M.*, ix, p. 462], the writers during 1930–1 made further similar observations on seven varieties, each of which is separately discussed in relation to the particular types of wastage affecting it.

Cox's Orange Pippin grown on a fertile light loam was found to be superior in storage quality to that grown on a clay-loam deficient in nutriment, in respect both of internal breakdown and bitter pit. Owing to its susceptibility to the former disease this

variety should not be carried at a temperature below 38° F. [cf. ibid., viii, p. 252]. Less bitter pit occurs in Cox's Orange Pippin at 32° than at 38°, but carriage at the former temperature cannot be recommended on account of the great severity of internal breakdown, followed by heavy losses from fungal decay, under these conditions. Earlier pickings of Cox's Orange Pippin tend to show more bitter pit than later ones.

Jonathans should be carried at a temperature above 35°, at or below which internal breakdown and deep scald are liable to develop, the latter disease continuing to increase slightly in the fruit after its removal from two months of storage. Deep scald seemed to be most prevalent in mid-season fruit; it does not necessarily appear first on the surface of the apple, but may start $\frac{1}{8}$ to $\frac{1}{4}$ in. below. Jonathan spot may be controlled by the avoidance of unduly late picking.

The Rome Beauty, Granny Smith, Cleopatra, and Worcester Pearmain varieties also kept best at 35°, 32° coming next in order of preference for the first-named. This variety should be picked early to avoid the risk of internal breakdown and of fungal infection on removal from storage. Granny Smith proved to be tolerant of a wide temperature range and both in this variety and in Cleopatra internal breakdown was restricted to the core. Worcester Pearmains are liable to a certain amount of internal breakdown at 32° while at 38° maturity is unduly accelerated, but on the whole the wastage in this variety, even among the very late pickings, was found to be remarkably small. The Dougherty variety also seems to be most accommodating as regards storage requirements, keeping well at 32°, 35°, and 38°, though somewhat insipid in flavour at the lowest temperature.

HEALD (F. D.) & BAKER (K. F.). **Some new observations concerning blue mold decay of Apples.**—*Proc. Washington State Hort. Soc.*, xxviii, pp. 164–174, 1932. [Received June, 1933.]

The information in this paper concerning the mode of infection and control of blue mould (*Penicillium expansum*) of apples in Washington has already been noticed from another source [*R.A.M.*, xii, p. 226].

**Black end of Pears.**—*Fruit World of Australasia*, xxxiv, 4, p. 209, 1933.

An apparently physiological condition referred to as 'black end' [cf. *R.A.M.*, xii, p. 103] and affecting William, Packham, Bosc, Laurence, and Clairgeau pear fruits in the Diamond Creek district of Victoria was first observed some five or six years ago, since when it has steadily become more prevalent. The disease appears at the calyx as a faint russet mark which turns black and extends to form a ring round the eye, sometimes spreading half-way down the side of the fruit, which may crack. The injury is superficial but the fruit becomes woody and unpalatable.

Black end appears as soon as the fruit is ready for picking and it may develop during storage. Once a tree becomes affected the trouble is said to recur each year, though, apart from the fruit, growth remains normal.

SCHILBERSZKY (K.). **Über die Ursachen der Apoplexie bei den Steinobstbäumen. II.** [On the causes of apoplexy in stone fruit trees. II.]—*Angew. Bot.*, xv, 2, pp. 106–122, 1933.

Further investigations on the factors affecting the occurrence of apoplexy or gummosis in stone fruit trees in Hungary and elsewhere [*R.A.M.*, xii, p. 227] are reported in this paper. Wounding, faulty methods of grafting, the use of incompatible stocks, and parasitic infection all play their part in the development of gummosis. Among the fungi most prominently concerned in gum formation are *Clasterosporium carpophilum* and *Sclerotinia cinerea* [ibid., xii, pp. 301, 302]. It was formerly believed that the conidial (*Cytospora*) stages of various species of *Valsa* were implicated in the causation of gummosis [ibid., xi, p. 60], but this view is refuted by the experiments of the writer and others, showing that these fungi can only attack trees already weakened or killed by adverse conditions. Many of the apoplectic trees examined by the writer during his extensive investigations showed no trace of fungi.

Control measures should include protection against the effects of frost, the application of lime to the soil where necessary, care to avoid superfluous wounding of the roots and crown, drainage, a plentiful water supply during dry periods, and prophylactic treatment against the spread of fungous infections.

SVOLBA (F.). **Russtau an Prunus domestica.** [Sooty mould on *Prunus domestica.*]—*Gartenbauwissensch.*, vii, pp. 282–292, 8 figs., 1932. [Abs. in *Neuheiten auf dem Geb. des Pflanzensch.*, xxvi, 3, p. 56, 1933.]

In the Kamp valley (Lower Austria) the sooty mould covering all the organs of plum trees infested by the scale insect *Eulecanium corni* was found to consist almost exclusively of *Dematium* [*Pullularia*] *pullulans* [*R.A.M.*, iii, p. 556; iv, p. 60], with the occasional participation of *Cladosporium herbarum*, *Stemphylium* sp., various moulds with a reddish-brown or white mycelium, and the pink yeast, *Torulopsis* sp. [ibid., xi, p. 642]. Heavy damage is caused by the joint effects of the insect and sooty mould.

ANDERSON (F. G.). **The phony Peach disease in Illinois.**—*Trans. Illinois State Hort. Soc.*, lxvi (*1932*), pp. 214–217, 1933.

Since 1927 the phony disease of peaches [see next abstract] has been found in eight counties in Illinois, most of the affected trees being 7 to 15 years old when the initial symptoms were detected. The source of infection cannot be definitely traced. The disease is briefly described in popular terms and growers are urged to make every effort to eradicate it from the State.

BRYANT (M. W.). **Report on the conference on the phoney Peach disease held at Memphis, Tennessee, on December 13, 1932.**—*Trans. Illinois State Hort. Soc.*, lxvi (*1932*), pp. 217–226, 1933.

At a conference on the phony peach disease held at Memphis, Tennessee, on 13th December, 1932, objections were raised to the

extension of the quarantine restrictions to Illinois and other States on the grounds (1) that the disease in question is readily controllable by the eradication and destruction of infected trees, and (2) that it is not transmissible by propagation. [These restrictions have since been removed: *R.A.M.*, xii, p. 528.]

Benton (R. J.) & Barnett (G. B.). **To control brown spot of Passion fruit.**—*Agric. Gaz. New South Wales*, xliv, 4, pp. 317–318, 1933.

This is a brief account of spraying experiments in 1932–33 at the Grafton Experiment Farm, the results of which showed that monthly applications from August to mid-January of 6–4–50 Bordeaux mixture gave excellent control of brown spot [*Macrosporium* sp.: *R.A.M.*, xii, p. 41] of passion fruit [*Passiflora edulis*], while in the unsprayed rows practically all the foliage had become diseased and 50 per cent. of the fruit was destroyed. It was noticed that the fruit on the sprayed plants matured almost two weeks earlier than that on the controls.

Martin (H.) & Salmon (E. S.). **The fungicidal properties of certain spray-fluids. X. Glyceride oils.**—*Journ. Agric. Sci.*, xxiii, 2, pp. 228–251, 2 figs., 1933.

In the tenth paper of this series [*R.A.M.*, xi, p. 731] the authors give a full report of their study of the fungicidal action on the conidial stage of *Sphaerotheca humuli* of various glyceride oils of vegetable and animal origin [ibid., xi, pp. 253, 464]. All the oils tested, with the exception of castor oil, when emulsified with 0·25 per cent. agral I [ibid., xii, p. 403], proved to be fungicidal at concentrations of 0·5 to 1 per cent., this property being associated with the glyceride structure of the oils, as indicated by the fact that it was destroyed by saponification. There was also evidence that toxicity was not affected by the presence in the oils, when applied with dilute solutions of agral I, of those impurities which are removable by refinement. Of the two components of the glycerides; glycerol and fatty acid, the former was shown not to be completely fungicidal and to cause leaf injury at 4 per cent., while the second, at 1 per cent., was phytocidal [i.e., lethal to the host tissues]. Triolein, prepared by synthesis from glycerol and oleic acid, was fungicidal at 0·5 per cent., and did not injure the hop leaves.

The type of emulsification used was shown to exert a considerable influence on the fungicidal properties of the glyceride oils. Stable emulsions produced by the two-solution method (in which the free fatty acid content of the oil is increased by the addition of oleic acid, the mixture being added to a suitable dilution of sodium hydroxide) were less effective than unstable emulsions obtained by agitation with dilute agral I solutions. Finally, it was found that emulsifiers alkaline in reaction or which require the addition of alkali are unsuitable for the preparation of sprays containing glyceride oils. Bordeaux mixture, on the other hand, proved to be suitable for this purpose [ibid., xi, p. 464].

SAUCHELLI (V.). **Flotation sulfur in agriculture.**—*Indus. & Engin. Chem.*, xxv, 4, pp. 363–367, 4 figs., 1 graph, 1933.

Flotation sulphur [*R.A.M.*, ix, p. 796, and above, p. 572] is derived from bituminous coal by the so-called liquid purification process (devised by the Koppers Company) [Pittsburg], which is based on the absorption of hydrogen sulphide in an alkaline solution. Subsequently, in the presence of a suitable catalyst, the hydrogen sulphide is broken down to yield elemental sulphur, which is recovered by a flotation process in the shape of extremely fine particles approaching colloidal dimensions (average 3 $\mu$) and prepared for the market in three forms: a wet paste, a dry, wettable dust, and a dry dust.

Since 1927 investigations on the efficacy of flotation sulphur in disease control have been conducted in all the important agricultural districts of the United States and Canada by the Crop Protection Institute, which is maintained by the Koppers Research Corporation. A tabulated account is given of these experiments, showing the value of the flotation sulphur preparations in the control of a number of well-known plant diseases.

GÖRNITZ (K.), TRAPPMANN (W.), NITSCHE (G.), & VOELKEL (H.). **Methoden zur Prüfung von Pflanzenschutzmitteln. Beiträge IV–VI.** [Methods of testing plant protectives. Contributions IV–VI.]—*Mitt. Biol. Reichsanst. für Land- und Forstwirtsch.*, 46, 94 pp., 15 figs., 2 diags., 12 graphs, 1933.

Under the general heading of new apparatus and methods [cf. *R.A.M.*, v, p. 566], the first-named author describes a special contrivance for determining the dosage of spray or dust materials deposited on the leaf surface during treatment; explains the mode of testing plant protectives for their resistance to washing off by rain; and discusses the maintenance of permanent cultures of *Plasmopara viticola* for the inoculation of vine leaves on which to test the efficacy of new fungicides. The remainder of this section and the other contributions deal with subjects of entomological interest.

MARSAIS (P.). **Pulvérisateurs et poudreuses modernes.** [Modern spraying and dusting apparatus.]—*Rev. de Vitic.*, lxxviii, 2023, pp. 223–226, 1 fig., 1933.

In this paper the author gives notes on, and some constructional details of, two new horse-driven machines (a sprayer and a duster) which are constructed by the Castaing works in Bordeaux, and of which Messrs. F. Béraud-Sudreau & Cie, 86, Rue Jules-Ferry, Caudéran-Bordeaux, are the concessionnaires. These machines are claimed to mark a considerable advance on those that are at present in general use.

**Pflanzenschutz in der U.d.S.S.R.** [Plant protection in the U.S.S.R.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xiii, 4, pp. 27–29, 1 map, 1933.

The aim of the Pan-Russian Institute for Plant Protection is the organization of all scientific work in the realm of plant protection in the U.S.S.R., including independent researches on the

most important phytopathological problems affecting the country; the perfecting of research methods; studies of the laws governing the periodical mass multiplication of pests and diseases; the investigation of control measures; and the education of highly qualified experts in plant protection. The last-named object is pursued at the educational institute for plant protection experts at Vladimir, whilst the headquarters of the Institute are at Leningrad and there are ten branches in different parts of the Republics. The departments of the Institute include general phytopathology, diseases and pests of forest trees, plant protection technique propaganda, and the supervision of imports and exports for pests and diseases.

LAUBERT (R.). **Über die Zunahme verheerender Pflanzenkrankheiten.** [On the increase of devastating plant diseases.]—*Gartenbauwirtsch.*, *1932*, 4, pp. 1–2, 1932. [Abs. in *Zentralbl. für Bakt.*, Ab. 2, lxxxviii, 8–12, pp. 267–268, 1933.]

A list is given of destructive fungous and bacterial parasites of horticultural plants (fruit, vegetables, and ornamentals) introduced into Germany within the last 100 years. Fifteen of the pathogens under discussion have only been known in the country since the beginning of the present century, the period from 1907–9 being marked by a particularly heavy invasion; they are *Cladosporium fulvum* [on tomato], *Corynespora* [*Cercospora*] *melonis* [on cucumber: *R.A.M.*, vii, p. 6 *et passim*], *Exobasidium japonicum* and *Septoria azaleae* [on *Rhododendron* spp.: ibid., x, p. 734], *Oidium euonymi-japonicae* [on *Euonymus japonicus*: ibid., viii, p. 579], *Microsphaera quercina* [on oak: ibid., xi, p. 682], *Sphaerotheca mors-uvae* [on gooseberry], *Uropyxis sanguinea* [*Puccinia mirabilissima*: on *Berberis aquifolium*: ibid., xii, p. 375], *Oidium hortensiae* [on hydrangea: ibid., xii, p. 175], bacterial tumours [*Bacterium tumefaciens*] on chrysanthemum [ibid., xi, p. 785], *Pseudoperonospora humuli* [on hops: ibid., x, p. 621], *P. cubensis* [on cucumber: ibid., vii, p. 7], *Synchytrium endobioticum* [on potato], *Graphium* [*Ceratostomella*] *ulmi* [on elm: ibid., xi, p. 275], and *Rhabdocline pseudotsugae* [on *Pseudotsuga taxifolia*: ibid., xii, p. 257].

KUHNHOLTZ-LORDAT (G.). **Les foyers permanents.** [Permanent foci.]—*Rev. Path. Vég. et Ent. Agric.*, xx, 3, pp. 118–127, 1 pl., 2 figs., 1933.

The author believes that a fuller understanding of the causes that bring about outbreaks of economically important plant diseases may be obtained by a study of the behaviour of related fungal diseases of wild plants. As an illustration of this he points out the striking parallel observed by him between the incidence of various downy mildews (*Peronospora* spp.) of weeds and that of the vine (*Plasmopara viticola*) in the Hérault in 1932, the former of which are endemic in the region. Furthermore, he gives his observations on an outbreak in 1932, after many years of quiescence, of *Armillariella* [*Armillaria*] *mellea* on different species of trees in the Mandon Park near Montpellier, probably due to the very wet conditions of that year. The spread of the fungus was traced

to two permanent foci of long standing in the park, from which infection is believed to have occurred through spores carried by running water or by floods, rather than through the air.

Bisby (G. R.). **The distribution of fungi as compared with that of phanerogams.**—*Amer. Journ. of Botany*, xx, 4, pp. 246–254, 1933.

From his studies on the distribution of the Uredinales, and of the fungi of Manitoba and India [*R.A.M.*, ix, p. 344; xi, pp. 545, 546], and from a survey of the contemporary literature on the relative predominance of phanerogams and fungi, the author concludes that the total number of species on the earth is evidently of the same order in both groups, although in the present state of knowledge the records of the former outnumber the latter by about two to one. Notwithstanding the smaller total number of species of fungi known, more fungi than flowering plants have been reported from various States and Provinces of North America which have been intensively surveyed (over twice as many, for instance, in Manitoba), and a similar ratio exists in certain European countries. In subtropical or tropical areas, such as India, the number of recorded spermatophytes greatly exceeds that of the fungi, but in those parts of the world the latter have been very inadequately studied. In general, it may be taken as established that the smaller the area surveyed, the greater is the excess of fungi over the flowering plants, with which they are predominantly associated, while in larger areas the totals approximate more closely.

The average distribution or range of species of fungi is more extensive than that of the phanerogams. Generally speaking, saprophytes (such as Myxomycetes, Mucorales, Pezizales, and Gasteromycetes), which are not commonly specific to their substrata, are more widely distributed than parasites. Even such obligate parasites as the rusts, however, are frequently more widespread than their individual hosts owing to their capacity for attacking more than one species.

It is clear from the evidence available that fungi commonly have a wide distribution over the earth, the chief limiting factor in their occurrence being the presence of appropriate hosts or substrata, while climatic conditions are apparently of lesser importance, though undoubtedly playing a part in the distribution of many species.

Dickinson (S.). **The technique of isolation in microbiology.**—*Phytopath.*, xxiii, 4, pp. 357–367, 3 diags., 1933.

The writer reviews the various methods of single cell isolation which have been published, under three heads: (1) in which the cells are separated by chance, usually in a volume of liquid, e.g., the dilution and pipette methods; (2) the cells are separated by design when lying in one plane, e.g., the dry needle and Dickinson methods [*R.A.M.*, v, p. 377], and (3) the cells are separated by force, e.g., the microscissors method.

The last-named method is based on a suggestion made by E. C. Stakman and consists in cutting the hyphae in two with a pair of

microscissors attached to a micromanipulator or isolator. The blades of the scissors are made of small pieces of an ordinary razor blade, very sharply pointed, and mounted at the ends of circular steel rods so as to meet the agar culture surface perpendicularly. One of the blades moves by a rack-and-pinion movement past the other, parallel to the microscope stage, the blades being so adjusted that their tips are on the same level and come into contact only when the movable blade passes the stationary one. Generally speaking, this method is applicable only to hyphae growing on the surface of the agar. In practice, the material is placed or grown on agar drops on cover-slips similar to those used in the isolation of small separate cells. Having completed the separation of the required cell by cutting those on either side of it, isolation may be effected by the use of the Dickinson isolator.

The following simple method of single cell isolation is described by the author. The material from which spores are to be isolated is placed on an agar drop on a cover-slip, inverted over a hole cut in a microscope slide. The latter is placed on the mechanical stage of the microscope with the hole directly over the condenser, on top of which is a cover-slip bearing an L-shaped glass rod, with its vertical arm tapering to a fine point and fastened to the cover-slip by plasticine. The tapered tip of the glass rod is raised or lowered by means of the condenser rack-and-pinion movement, while the actual handling of the spores is done by the dry needle or Dickinson method.

VOLKONSKY (M.). **Procédé rapide et simple de purification des cultures de champignons oomycètes.** [A rapid and simple method for the purification of cultures of oomycetous fungi.] —*Comptes rendus Soc. de Biol.*, cxii, 16, pp. 1657–1658, 1933.

The following method has been found both simple and efficacious in the purification from contamination of oomycetous fungi in general and of *Phytophthora* spp. in particular. The slowly growing creeping mycelium, contaminated by bacteria, is placed on a fragment of nutrient medium at the bottom of a Petri dish and covered by a lid into which a layer of agar has been poured; the dish is then inverted. Under these conditions the aerial mycelium develops rapidly, reaching the agar on the lid in four to ten days when the hyphae connecting the lid with the dish can be broken. A dilute Sabouraud's medium and soy-bean or malt agar are suitable for this method of purification.

GHIMPU (V.). **Sur les maladies à virus de quelques Solanées.** [On the virus diseases of some Solanaceae.]—*Comptes rendus Soc. de Biol.*, cxii, 11, pp. 1113–1115, 1933.

The following virus diseases have been observed in Rumania: mosaic of tobacco, *Petunia violacea*, tomato, potato, and various wild Solanaceae; ring spot of tobacco (also observed on *Nicotiana affinis*, *N. quadrivalvis*, *N. viscosa*, and the hybrid *N. tabacum* × *N. glauca*); and veinbanding and spot necrosis of tobacco [*R.A.M.*, xi, p. 607]. These diseases scarcely ever occur in the greenhouse and seed-beds, indicating that the seed is not, in general, respon-

sible for the transmission of the virus. Some wild plants and the débris of annuals affected by virus diseases maintain their virulence for lengthy periods under unfavourable conditions. Thus, tobacco stems and roots kept for six months on a stove at a temperature of 50° to 60° C. were found to be capable of producing the typical mosaic symptoms in healthy seedlings 10 to 15 days after inoculation by rubbing.

The inoculation of growing tobacco plants by the mosaic virus resulted in a number of foliar and floral malformations in addition to the usual symptoms, e.g., twisting of the flowers, splitting of the petals, sepals, and stamens, synanthia, staminodia, tri- and quadrilobate stigmas, supernumerary petals and pollen sacs, and various other forms of atrophy, hypertrophy, or metamorphosis. The following modifications were observed in the cells of diseased tobacco leaves: fragmentation of the vacuome, abundant formation of calcium oxalate crystals in the vacuolar juice, degeneration of the chloroplasts, excessive hydrolysis of starch, and the formation of proteid crystals and of X-bodies.

A marked improvement in the condition of mosaic tobacco plants was effected by the application of nitrogen or compost to the soil. *P. violacea* plants lost all trace of mottling after 30 days under bell jars at a temperature fluctuating between 20° and 45°.

Mosaic was found not to be transmissible from *P. violacea* to tobacco and vice versa, or from tobacco to *Soja hispida* and vice versa. *N. tabacum* grafted on *N. glauca* did not contract mosaic on inoculation of the stock, showing that the virus is incapable of attacking or even passively traversing the latter species.

SALAMAN (R. N.). **Protective inoculation against a plant virus.** —*Nature*, cxxxi, 3309, p. 468, 1933.

In a recent series of experiments at the Potato Virus Research Station, Cambridge, the writer inoculated by needle healthy White Burley tobacco seedlings from both the green and yellow areas of a fairly severely virus *x*-infected leaf of the same variety [*R.A.M.*, xi, p. 594]. Two distinct clinical conditions developed as a result of this operation, viz., an extremely mild disturbance when inoculum from the green areas was used, designated as the *G* type of *x*, and a very severe disease from the yellow areas, characterized by large, bright yellow patches on a pale green background, and by dwarfing (the *L* type of *x*). By mixing the *G* and *L* tissue extracts in varying proportions *in vitro* and inoculating them into tobacco seedlings, it was shown that a mixture of 1 *L* : 9 *G* produces a preponderantly *G* reaction, whereas blends with less of the *G* element evoke a reaction similar to that of *L*. Subcultures from the mixed yellow and green areas thus produced yield the original *L* and *G* types, showing that the two strains do actually mix and are not neutralized the one by the other.

When tobacco plants inoculated with the mildest type of the *G* form of the *x* virus are reinoculated nine days later either with the *L* strain or with the most necrotic type of *x*, no further reaction ensues, the test plants retaining their barely perceptible *G* type of reaction and presenting complete immunity from any

further attacks of the $x$ virus. It was subsequently shown that this protection against the virulent $x$ strains is developed on the fifth day after the preliminary inoculation, and some four to five days before any systemic response to $G$ is apparent. Subcultures from such doubly inoculated plants yield only the $G$ type of the $x$ virus, indicating that once the plant cell has formed a symbiotic union with the non-virulent strain it is incapable of entering into further relations with any other virus elements of the same generic type [cf. ibid., xi, p. 751].

In *Datura stramonium* both the $L$ and the necrotic forms of $x$ produce fatal effects, which may be obviated, however, by a preliminary dose of the $G$ strain of $x$. The latter also affords protection against Hy (*Hyoscyamus*) IV [ibid., xii, p. 243], but is powerless against K. M. Smith's $y$ potato virus [ibid., xii, p. 42] and Johnson's No. 1 common tobacco mosaic [ibid., xii, pp. 314, 398].

No evidence of a mild or symptomless $G$ form, or of any protective mechanism, has yet been found in the green 'veinbanding' islets, a late development of tobacco leaves infected by the $y$ virus.

ALDRICH-BLAKE (R. N.). **On the fixation of atmospheric nitrogen by bacteria living symbiotically in root nodules of Casuarina equisetifolia.**—*Oxford Forestry Mem.* 14, 20 pp., 2 pl., 1 fig., 1 graph, 1932.

Investigations on the fixation of atmospheric nitrogen by the bacteria occurring as symbionts in the root nodules of *Casuarina equisetifolia* [*R.A.M.*, xi, p. 797] were initiated by the writer at the Forest Research Institute, Dehra Dun, United Provinces, India, in April, 1930, and continued after his return to England by his colleagues H. G. Champion and M. V. Laurie, the seedlings being sent to Oxford for examination.

The plants were grown under strictly controlled conditions in pots in sieved and washed grey sand from a river-bed with a nitrogen content of 0·003 per cent., to which appropriate quantities of pure chemical nutrients were added. The inoculum consisted of thin slices of bacterial nodules (10 gm. per pot) from Bombay, introduced into four holes round each seedling. Each control pot was similarly inoculated with sterilized material. About fifteen months after inoculation the infected plants presented a very sturdy appearance. The stems and main branches were thick and woody, with dark green shoots, in contrast to the yellowish-green of the controls and to the reddish-yellow of another series receiving ammonium nitrate. The roots of the inoculated plants completely filled the pots with an interwoven mass and bore nodules up to 3·8 cm. in diameter, whereas none were found on the controls. The inoculated seedlings reached a mean height of nearly 55 in., the corresponding figures for the controls and for the series treated with ammonium nitrate being about 16·5 and 26, respectively. The aggregate dry weight of the inoculated roots was 133·50 ± 5·94 gm. per pot, compared with 9·28 ± 1·66 and 33·83 ± 1·39 gm. for the controls and ammonium nitrate series, respectively. The nitrogen content of the inoculated roots (per cent. of dry weight)

was 1·31 ± 0·08, compared with 0·96 ± 0·02 and 0·77 ± 0·63 for the controls and ammonium nitrate series, respectively.

The results of these experiments are considered to prove that *C. equisetifolia* is among the increasing number of plants now known to obtain atmospheric nitrogen through bacteria symbiotic in their roots or leaves. Bacterial nodules are also present on the roots of five other species of *Casuarina*, viz., *C. muricata*, *C. quadrivalvis*, *C. stricta*, *C. glauca*, and *C. cunninghamiana*, and the use of trees of this genus as hosts for the valuable sandalwood tree [*Santalum album*] is recommended.

Magrou (J.) & Magrou (Mme M.). **Sur les variations d'activité des Rhizoctones d'Orchidées.** [On the variations of activity in the *Rhizoctonia* spp. of the Orchidaceae.]—*Ann. Sci. Nat.*, *Bot.*, Sér. X, xv, 1, pp. 303–305, 1933.

In an attempt to reactivate a fairly old isolation of *Rhizoctonia repens* [*R.A.M.*, xi, p. 388] which had lost the ability to induce germination in *Cattleya* seeds the authors made sowings of this host on salep agar in seven tubes, two of which acted as controls, while three were inoculated with a culture eight months and twelve days old (mycelium C) and five others with one ten months old (mycelium C′). The two controls failed to show any growth, a slight growth appeared in one tube inoculated with mycelium C, and leaf-bearing seedlings developed in two of the tubes inoculated with mycelium C′. After about four and a half months, mycelium ($C_1'$) was isolated from one of the seedlings obtained from inoculation with mycelium C′ and was used to inoculate seven sowings of *Cattleya*. These gave 18 germinations in all, representing an average of 2·57 germinations per tube. Three sowings inoculated with mycelium C′ which had been kept in culture for fifteen months gave an average of 1·33 germinations per tube.

The activity of the mycelium C′ was thus doubled by a four and a half months' association with the *Cattleya* seedling.

Eftimiu (Panca). **Sur la présence d'un champignon chez Bucegia romanica Radian.** [On the presence of a fungus in *Bucegia romanica* Radian.]—*Comptes rendus Acad. des Sciences*, cxcvi, 13, pp. 957–959, 1933.

*Bucegia romanica* is a somewhat uncommon representative of the Marchantiaceae in the Carpathian mountains of Rumania, where it occurs in close association with *Preissia commutata* and *Fimbriaria lindenbergiana*, between which it may, in fact, be a hybrid. An anatomical study of the liverwort revealed the presence, in the thalli bearing the female inflorescences, of an endophytic fungus with septate, vacuolate hyphae [cf. *R.A.M.*, xii, p. 235]. Hitherto only a sharply defined zone of the chlorophyll tissue has been found to show infection, but there is reason to believe that the plant is penetrated by way of the rhizoids. The nuclei of the infected cells degenerate, the cytoplasm disappears, and the slightly hypertrophied cellular cavity becomes filled with hyphae. The fungus further appears to act on the neighbouring cells, which gradually lose their staining capacity.

MATSUURA (I.). **Experimental studies on the saltation in fungi. VI. (Preliminary report.) On the saltation in the genus Brachysporium.**—*Journ. Plant. Protect.*, xix, pp. 121–139, 1 pl., 1 fig., 1932. (Japanese.) [Abs. in *Japanese Journ. of Botany*, vi, 3, p. (75), 1933.]

Saltation to a white mycelium was observed in the writer's cultures of the strains of *Brachysporium* parasitic on *Cynodon dactylon*, *Setaria italica*, red pepper [*Capsicum annuum*], and *Cyperus iria* in Japan [*R.A.M.*, x, p. 541]. As a rule the white patches produced along with the normal black mycelium persisted through several generations in monospore cultures, but a few cases of partial or total reversion to the original type were noticed. The pathogenicity of the saltant from *Cynodon dactylon* was found to be stronger towards its original host and weaker towards rice than in the case of the parent. The frequency of saltation was not increased by irradiation.

MATSUURA (I.). **Experimental studies on the saltation in fungi. VII. (Preliminary report.) On the mechanism of the occurrence of 'island' type of saltation.**—*Journ. Plant Protect.*, xix, pp. 409–428, 1 pl., 1932. (Japanese.) [Abs. in *Japanese Journ. of Botany*, vi, 3, pp. (75)–(76), 1933.]

Two- to three-day-old cultures of *Helminthosporium* sp. were observed to show a sinking of the aerial strands of hyphae due to the production from the under surface of a liquid secretion. This process, termed 'pseudomyceliose', results in a weakening and attenuation of the hyphae involved. It was noticed in association with the formation of 'island-like' saltants, and the liquid is believed to contain some metabolic product to the action of which the saltation is attributed.

CAMPANILE (SILVIA). **Composizione chimica delle spore di parassiti vegetali di cereali.** [The chemical composition of the spores of vegetable parasites of cereals.]—*Nuovi Ann. Agric.*, xii, 4, pp. 640–648, 1932. [Received April, 1933.]

Analysis of the ash of the spores of *Ustilago avenae*, *U. hordei*, *U. tritici*, and *U. maydis* [*U. zeae*] showed them to contain, respectively, 32·23, 15·3, 8·12, and 9·2 parts of silica, 29·1, 48·65, 52·2, and 52·4 parts of potassium oxide, 17·6, 25·2, 25·47, and 18·5 parts of phosphorus pentoxide, 8·19, 4·83, 5·13, and 4·35 parts of calcium oxide, and 2·84, 3·05, 3·9, and 2 per cent. of nitrogenous material. The corresponding figures (obtained from an examination of the literature of the subject) for the seeds of the respective hosts, oats, barley, wheat and maize were 39·18, 25·91, 1·96, and 2·09 parts of silica, 17·9, 20·92, 31·16, and 29·78 parts of potassium oxide, 25·64, 35·1, 47·22, and 45·61 parts of phosphorus pentoxide, and 3·6, 2·64, 3·25, and 2·17 parts of calcium oxide.

These figures are considered to show that a parallel may be established between the chemical composition of cereal seeds and that of the spores of the fungi which attack them; the parasitism of the cereal smuts may be conditioned to some extent by alimentary needs, the specific nature of the attack on a particular host being partly due to the alimentary possibilities of that host. Attention

is drawn to the large nitrogen, phosphorus, and potash content of the spores, and to the fact that whereas in the seeds phosphorus pentoxide predominated over potash, in the spores the reverse was the case. It is thought that the large potash content present in the spores of the cereal smuts may account for their tendency to induce cellular multiplication and the virulence shown by the promycelium towards growing tissues.

The large quantities of nitrogen, potash, and phosphorus taken up by the fungus to form spores are removed from the host at or about flowering time, when they are present in the inflorescences in the largest amounts, so that the fructification of the smuts of barley, oats, and wheat (but not maize, as *U. zeae* is able to fructify on the vegetative organs) at the same time and in the same place as that of the host can be considered to depend on alimentary requirements. Preliminary examination of the uredospores of wheat rusts [*Puccinia* spp.] showed that although these develop on other parts than the floral organs they also contained high percentages of phosphorus pentoxide and potash. Hence spore formation on Gramineae attacked by smuts or rusts must very seriously weaken the plant, while the removal of substances necessary for seed formation explains the reduced fructification on the part of the host observed in cereal rusts.

The spores of *Tilletia caries* were found to contain 38·7 per cent. phosphorus pentoxide and 36·19 per cent. potassium oxide. When wheat caryopses were completely invaded by this fungus it was found that the latter had used up the potash and phosphorus elaborated by the host for seed formation.

VERPLANCKE (G.). **Étude comparative de Pommes de terre d'origines diverses. II. Résultats des expériences faites en 1932.** [A comparative study of Potatoes of various origins. II. Results of experiments made in 1932.]—*Bull. Inst. Agron. et des Stat. de Recherches de Gembloux*, ii, 1, pp. 45–73, 1 graph, 1933. [Flemish, German, and English summaries.]

In further tests of the value of seed potatoes from Holland and the Ardennes [*R.A.M.*, xi, p. 800], tubers of the Industrie variety grown for one year in various localities in Belgium were planted in 1932 in four districts, comparisons also being made with fresh seed of the same variety.

The results obtained [which are tabulated, expressed graphically, and fully discussed] showed that the degeneration diseases present were leaf roll, mottling, mild mosaic, rugose mosaic, crinkle mosaic, aucuba mosaic, and streak. Cultivation for one year in each locality produced an increase in the percentage of leaf roll, the incidence of which amounted to 2 to 4 per cent., 4 to 9 per cent., 6 to 25 per cent., and 59 to 79 per cent. after cultivation at Gembloux, in the Campine, at St. Hubert, and at Ruysselede, respectively. In general, mottling and mild mosaic, the other chief virus diseases, were less prevalent in 1932 than in 1931. In the Belgian Ardennes potato fields apparently quite free from virus diseases were found adjacent to others where over 75 per cent. of the plants were affected.

Taken as a whole, the results (as in the previous year) showed

that the certificated Dutch Industrie potatoes were superior both as regards freedom from virus diseases and yielding capacity to those from the Ardennes.

KÖHLER (E.). **Untersuchungen über die Viruskrankheiten der Kartoffel. I. Versuche mit Viren aus der Mosaikgruppe.** [Investigations on the virus diseases of the Potato. I. Experiments with viruses of the mosaic group.]—*Phytopath. Zeitschr.*, v, 6, pp. 567–591, 15 figs., 1933.

A detailed account is given of the writer's studies on the nature of five viruses isolated from potatoes in Germany and herein designated M23, M29, H19, R77, and G.A. Of these M23 and M29 were derived from plants of the Kl. Spiegeler Wohltmann variety received from Halle, H19 from the same variety from Leipzig, G.A. from a mosaic greenhouse plant of the Gustav Adolf variety, and R77 from a new Pomeranian selection cultivated for the first time at Dahlem, Berlin. Other viruses were used in a limited number of tests.

The M23 virus produced on potato leaves a conspicuous interveinal mottling, especially at the tips and edges of the leaflets, but no pathological changes in the habit of growth nor curling of the pinnae. Identical symptoms were produced by a virus (M17) from another source. H19 also caused pronounced mosaic of the interveinal areas, accompanied in this case by marked crinkling or rolling of the leaflets, the tips of which were sometimes curved to the right or left. Similar results followed inoculation with a virus termed M18. Plants inoculated with M29 developed extensive mottling and curling of the leaves, the pinnae of which were abnormally small, with necrotic streaks on the stem and on the apical veins of the under side of the pinnae. The type of mosaic induced by this virus (and by M11, M13, M16, M24, and M25) was characterized by much more extensive curling than that from H19 and M18. Plants infected with the R77 virus in the field showed a striking coarse yellowish mosaic with a slight crinkling of the leaves; in August the symptoms entirely disappeared and the plants appeared quite normal.

Tests of these viruses were made on various hosts. The G.A. virus produced on Samson (Turkish) tobacco plants a 'clearing' of the veins whether it was transmitted by *Myzus persicae* or by rubbing as described by K. M. Smith for his *y* virus [*R.A.M.*, xi, p. 394]. Necrotic spots or rings were not formed and the leaves always remained smooth. *Nicotiana longiflora* plants inoculated with R77 contracted severe mosaic of the yellow-chlorotic type. The inoculation of *N. longiflora* with M23 resulted in the development on the leaves of dark green rings with a pale green central spot surrounded by pale green circles, sometimes followed by concentric necrotic rings in the final stages. H19 produced pale green, concentric rings with only a few isolated yellow spots near the veins. Samson tobacco plants inoculated with M23 from *N. longiflora* developed chlorotic ring spots or irregular mottling, while H19 from the same source produced slight clearing of the veins and small, incomplete ring necroses [cf. ibid., xii, pp. 119, 120]. Further experiments on Samson tobacco with M23, H19, M29, and

R77 indicated that M29 and R77 are related strains, the former presumably resulting from a blend of R77 and another virus (probably M23), and definitely distinct from M23 and H19. Some degree of affinity would also appear to exist between M23, H19, and R77, while G.A. stands apart from any of the others. *Datura stramonium* plants inoculated with M23, H19, and R77 from Samson tobacco developed typical mosaic symptoms, which were most pronounced with M23 and least so with H19. On *Petunia nyctaginiflora* plants H19 caused extensive veinbanding, R77 a condition transitional between a finely speckled mosaic and faint veinbanding, while M23 gave negative results.

The data of these and other experiments [full particulars of which are given] indicate that G.A., transmissible by *M. persicae*, is in all probability identical with the widespread *y* virus; M23 with *x* and ring spot [ibid., x, p. 615 *et passim*]; R77 and H19 new and apparently undescribed, unless they are related to the Kentucky 'etch' viruses [ibid., x, pp. 213, 410]; and M29, a blend of M23 and R77. A close relationship probably exists between M23, R77, and H19, none of which is transmissible by *M. persicae*, while a connexion is further denoted by the similarity of the symptoms caused by these viruses, their identical behaviour in combination with G.A., and their localization in the Halle-Leipzig district (possibly favoured by the sugar beet cultivation there).

KÖHLER (E.). **Die Rolle der Viruskrankheiten beim Kartoffelabbau.** [The rôle of the virus diseases in Potato degeneration.]—*Angew Bot.*, xv, 2, pp. 122–131, 1933.

Continuing his studies on the virus diseases of plants [*R.A.M.*, xi, p. 796], the writer here summarizes and discusses the information at present available concerning the part played by these disturbances in the complex phenomenon of potato degeneration. Without a doubt leaf roll [see next abstract] is the most injurious and economically important of the potato viruses in Europe, followed by those of the mosaic group, of which at least five must be differentiated, viz., K. M. Smith's *x* and *y*, Murphy's and M'Kay's A [ibid., xi, p. 740], and Köhler's R77 and H19 [see preceding abstract]. The actual part played by the virus diseases in the etiology of degeneration can only be determined by an analytical study of all the environmental and hereditary factors involved in the process.

SCHAFFNIT (E.) & JÖHNSSEN (A.). **Untersuchungen über Viruskrankheiten. (II. Mitteilung). Beiträge zur Kenntnis der Blattrollkrankheit der Kartoffel.** [Studies on virus diseases. (Note II.) Contributions to the knowledge of the Potato leaf roll disease.]—*Phytopath. Zeitschr.*, v, 6, pp. 603–612, 6 figs., 1933.

The successful results [which are described] of the writers' experiments in the transmission of leaf roll from diseased to healthy potato plants by means of aphids (*Myzus persicae*) and by grafting are considered fully to establish the virus origin of the disease and at the same time to dispose of the physiological

theories of Schander, Schweizer, and Merkenschlager [*R.A.M.*, xi, p. 668].

KOCH (K. L.). **The nature of Potato rugose mosaic.**—*Phytopath.*, xxiii, 4, pp. 319–342, 4 figs., 1933.

The results of the writer's experiments [which are fully discussed and tabulated] confirmed previous evidence to the effect that the rugose mosaic of potato is due to the combined action of the mottle virus [*R.A.M.*, v, p. 119; xii, pp. 108, 319], normally present in healthy potatoes, with that of veinbanding [ibid., x, p. 409]. The potato ring spot virus may, however, replace the mottle in the combination with almost identical results.

Both the mottle and ring spot viruses are readily transmissible by plant extract, but not by means of aphids, whereas the veinbanding virus may be conveyed both by plant extract and by the aphids *Myzus persicae* and *Macrosiphum solanifolii* [*M. gei*]. The veinbanding virus therefore may be isolated from the rugose mosaic complex by means of the aphids, whereas the mottle virus may be separated on the basis of differential properties. The ring spot virus has hitherto been found exclusively in association with mottle but can be separated from it by means of the differential rates of progress of the two viruses through the tobacco plant, the first symptoms of the former developing about three days after inoculation, while those of the latter were not apparent before the seventh day.

The thermal death-point of the veinbanding virus was found to be 60° C., the corresponding figures for ring spot and mottle being 68° and 70°. The veinbanding virus resists ageing *in vitro* only about five days, whereas ring spot and mottle may survive this process as long as 28 days. Veinbanding will withstand a dilution of only about 1 to 5,000, the corresponding figures for ring spot and mottle being 1 in 10,000 and 1 in 100,000, respectively. Veinbanding was also found to be more sensitive to chemical treatments than either of the other viruses, being destroyed by nitric acid (1 in 500) in 30 minutes and by 37 per cent. formaldehyde (1 in 100) and 50 per cent. absolute alcohol in one hour.

Tests of the comparative reaction to rugose mosaic of six standard potato varieties indicated that Green Mountain and Bliss Triumph are highly susceptible, while Early Rose, Early Ohio, Irish Cobbler, and Rural New Yorker are relatively resistant, particularly the last-named. Susceptibility to veinbanding was shown by tomato, tobacco (*Nicotiana tabacum*, *N. glutinosa*, and *N. rustica*), *Nicandra physaloides*, *Solanum nigrum*, and *Physalis pubescens*, from which the virus was readily recoverable by artificial inoculation to tobacco. It is possible, therefore, that aphids transmit the veinbanding virus from weed hosts to neighbouring potato plants which, already harbouring the mottle virus, would then develop rugose mosaic. The existence of certain varieties or strains free from mottle and ring spot suggests the use of such stocks as a possible method of combating rugose mosaic.

Comparative studies on material of crinkle A [ibid., xi, p. 594] supplied by Dr. Salaman showed that it contained a virus which

produced a mottling on tobacco similar to that of the mottle virus but that it did not contain the veinbanding virus; furthermore, the author is of opinion that it is unlikely that Salaman's streak is identical with the American rugose mosaic. Evidence was also obtained of the occurrence of the veinbanding and mottle viruses in Dutch potatoes.

SCHLUMBERGER [O.]. **Versuche zur Bekämpfung des Kartoffelschorfes im Jahre 1932.** [Experiments in the control of Potato scab in the year 1932.]—*Mitt. Deutsch. Landw.-Gesellsch.*, xlviii, 10, pp. 195–197, 3 figs., 1933.

Continuing his experiments on the control of potato scab [*Actinomyces scabies*] in Germany by the use of resistant varieties combined with an appropriate fertilizing scheme [*R.A.M.*, xi, p. 321], the writer found that a certain reduction of infection in the highly susceptible Böhm's Allerfrüheste Gelbe and the fairly resistant P.S.G. Maibutter followed 8 applications of superphosphate (4 doppelzentner per hect.), 4 of ammonium superphosphate 9 : 9 (6 doppelzentner per hect.), and 4 of ammonium sulphate. These results, taken in conjunction with Eichinger's protracted experiments [ibid., xi, p. 597] appear to indicate the beneficial action on the potato crop of a well-balanced manuring system, but so far the writer has found no consistent connexion between the various fertilizers and the soil reaction.

None of the six varieties tested for the third time showed marked resistance, but Böhm's Ovalgelbe may be regarded as moderately resistant. Of the varieties tested for the second time, E. Modrow's Aal maintained the high degree of resistance shown the previous year. Promising results were obtained in the first trials with Modrow's Abendstern, Altgold (Raddatz), Edelweiss and Oststärke of the Ostmärk. Saatb. [Eastern Mark seed-testing establishment], and v. Kameke's Robinia; eight others were sufficiently resistant for further testing, while six (including v. Kameke's Centifolia and Pepo) were discarded as too susceptible.

DJELALOFF (R.). Порошистая парша (**Spongospora solani Brunchorst**) Картофеля в Наримановском районе **А.С.С.Р.** [Powdery scab (*Spongospora solani* Brunchorst) of Potato in the Nariman district of A.S.S.R.]—Pamphlet issued by *Азербайджанский Сел.-Хоз. Инст.* [*Azerbaijan Agric. Inst.*], Baku, 12 pp., 1933. [In the Azerbaijan language, with Russian translation and English summary.]

The author states that investigations in 1931 disclosed the hitherto unsuspected presence of powdery scab of potatoes (*Spongospora subterranea*) in several mountainous localities of the Nariman district of Azerbaijan. Steps are being taken to prohibit the exportation of potatoes from these localities, since the disease is subject to quarantine measures in Russia, where it is stated to be of very rare occurrence.

NISIKADO (Y.) & MATSUMOTO (H.). **Weitere, vergleichende Untersuchungen über die durch Lisea fujikuroi Sawada und Gibberella moniliformis (Sh.) Wineland verursachten Grami-**

**neenkrankheiten.** [Further comparative studies on the diseases of Gramineae caused by *Lisea fujikuroi* Sawada and *Gibberella moniliformis* (Sh.) Wineland.]—*Ber. Ōhara Inst. Landw. Forsch.*, v, 4, pp. 481–500, 3 pl., 1933.

A fully tabulated account is given of the writers' further comparative studies on the diseases of Gramineae caused by *Lisea* [*Gibberella*] *fujikuroi* and *G. moniliformis* in Japan [*R.A.M.*, xi, p. 400].

Inoculation experiments under controlled conditions showed that *G. fujikuroi* can induce an abnormal elongation of the seedlings of *Panicum miliaceum*, sorghum, barley, and sugar-cane, in addition to rice and maize, while the germination of *Setaria italica* seed was prevented by the fungus. The Formosa strain of *G. fujikuroi* showed a particularly high degree of pathogenicity which was only equalled in one test on maize by that from Kyoto. In a previous experiment by the first-named writer in Berlin, the Mexican strain of *Fusarium moniliforme* var. *majus* [ibid., xi, p. 332] proved about equal in pathogenicity to rice and maize with the Kyoto strain of *G. fujikuroi*, a fact leading to the erroneous conclusion that *F. moniliforme* var. *majus* was more nearly related to *G. fujikuroi* than to the type species, *G. moniliformis*. In the present tests the Mexican strain of *F. moniliforme* var. *majus* displayed no very strikingly parasitic behaviour, except in one case with barley from which no reliable inference can be drawn.

[An abstract of an account of these investigations from a different source is given in *Japanese Journ. of Botany*, vi, 3, pp. (79)–(80), 1933.]

KUROSAWA (E.). **On certain experimental results concerning the over-elongation phenomenon of Rice plants which owe to the filtrate got from the culture solution of the 'bakanae'-fungi.**—*Rept. Taiwan Nat. Hist. Soc.*, xxii, pp. 198–201, 1932. [Abs. in *Japanese Journ. of Botany*, vi, 3, pp. (72)–(73), 1933.]

The excessive elongation of rice plants [in Formosa] produced by the filtrate of the culture solution of the 'bakanae' fungus (*Lisea* [*Gibberella*] *fujikuroi*) [see preceding abstract] was found to be due to a certain product of the fungus induced only by the presence in the medium of acid potassium phosphate, potassium nitrate, sulphate, or chloride, or calcium nitrate. The phenomenon was not observed when acid potassium phosphate was replaced by calcium or sodium phosphate, whence it is concluded that potassium, not phosphoric acid, is the essential element in the production of the elongating substance.

The 'bakanae' secretion is insoluble in alcohol, ether, toluol, chloroform, xylol, and carbon disulphide, is non-volatile, permeable through collodion membranes, and capable of adsorption by powdered lime-charcoal. It remains unchanged at a temperature of 100° C. for a number of hours either in a dry or moist state, is resistant to cold and direct sunlight, and can retain its properties for one to six years.

MURRAY (R. K. S.). **Diseases of Rubber in Ceylon, 1932.**—*Trop. Agriculturist*, lxxx, 4, pp. 214–217, 1933.

During the period under review evidence was obtained that *Fomes lignosus* may give rise to serious problems in replanting old rubber areas in Ceylon. It appears that in certain instances the fungus remains dormant in the soil and that the staled culture becomes reinvigorated during replanting.

A die-back of 1- to 6-months old green shoots from the bud union was observed on two estates in the Kalutara district and at the Experiment Station, Nivitigalakele. In all the specimens examined a *Diplodia* was present and appeared to have entered at or near the union. Inoculations of green bud shoots with the *Diplodia* gave negative results from which it was concluded that the fungus was only a secondary factor in the disorder. Examination of the union of affected plants showed the invariable presence at the junction of the shoot and stock of an internal pad of coagulated latex presumably caused, as in Java, by an internal fissure [*R.A.M.*, xi, p. 202]. In all cases the shoot bore a very heavy head of foliage, and excessive movement of the shoot in the wind in conjunction with the internal fissure had probably caused a rupture at the union, through which the fungus had entered.

After severe drought in January and February the bark of 2- to 3-year old buddings died back near the union. A study of the condition on an estate in the Ratnapura district showed that the primary cause was sun scorch which had caused the bark on the raised portion of the 'elephant foot' to crack. In most cases *Diplodia* had gained entrance through the cracked bark and had passed up the stem into the wood.

Notes are given on the prevention of decay in the stock snag before callusing is completed by treatment with a waterproof mixture.

**Amtliche Pflanzenschutzbestimmungen.** [Official plant protection regulations.]—*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, iv, p. 6, pp. 220–221, 228–229, 250–255, 259–261, 275–278, 1933.

GERMANY (BRUNSWICK and THURINGIA). Orders dated 25th January, 1933, and 28th December, 1932, respectively, provide for the control of elm disease (*Graphium* [*Ceratostomella*] *ulmi*) in Brunswick and Thuringia on the lines defined in similar regulations already operative in other parts of Germany [*R.A.M.*, xi, p. 272].

POLAND. An order of the Polish Ministry of Agriculture, dated 3rd August, 1932, aims at restricting the spread of potato wart (*Synchytrium endobioticum*) [ibid., viii, p. 664] by the prohibition for use as seed of tubers from infected fields, which must further be boiled or steamed before feeding to stock. Potatoes from infested fields may not be washed in running water, canals, ditches, ponds, or lakes, but the water for this purpose must be emptied into a special pit, at least 0·75 m. in depth, situated at a minimum distance of 5 m. from any well, manure pit, or the above-mentioned waters; after use the pit must be disinfected. The washings from infected material in factories may not be

poured on to the fields. All refuse from diseased potatoes must be buried in a pit at least 0·75 m. in depth. No potatoes or their refuse, root crops, bulbs, weeds, soil, or organic manure may be moved from a farm on which wart disease occurs. Only recognized resistant varieties may be grown on infected land and local authorities may prohibit the cultivation of potatoes altogether on such areas.

Syria and Lebanon (French Mandated Territory). The regulations (6th June, 1931) governing the importation into the French mandated territory of Syria and Lebanon of plants and plant materials are summarized. The products involved are scions for grafting, cuttings, flower bulbs, cut flowers, leaves, fruits, vegetables, root tubers, bulbous tubers, root-stocks, and seeds, and also the materials used for packing them; the restrictions do not apply to such plants or parts thereof as are destined exclusively for culinary, industrial, or medical use, except in special cases. Plant consignments must be accompanied by certificates of freedom from diseases, failing which they will be subjected to examination by the local agricultural officials at the port of entry and dealt with at their discretion.

Bulgaria. An order of the Ministry of Agriculture, dated 25th October, 1932, defines the regulations governing the import into, transit through, and export from Bulgaria of all kinds of living plants (wild and cultivated) and parts thereof. Plant consignments for Bulgaria from foreign countries must be accompanied by certificates of freedom from infectious diseases, with express reference, in the case of material shipped direct from North or South America, Australia, Japan, China, or Hawaii, to *Synchytrium endobioticum* and *Spongospora subterranea* [on potato], *Diplodia zeae* [on maize], *Bacillus amylovorus* [on apples, pears, and other fruits and ornamentals], *Endothia parasitica* [on chestnut], and *Plowrightia morbosa* [*Dibotryon morbosum* on cherries and plums]. For transit through the country the consignments must be packed in such a way as to obviate any possibility of the dissemination of infection. Directions are given for procuring the necessary certificates to accompany plant consignments from Bulgaria to foreign countries.

**Amtliche Planzenschutzbestimmungen.** [Official plant protection regulations.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, iv, 5, pp. 117–183, 1933.

A summary is given of the existing plant protection regulations in Egypt, embodying the orders of 1st and 20th January, 1916, 22nd June, 24th November, and 15th December, 1919, 27th May, 1920, 1st March, 1922, 18th June, 1931, and 30th August, 1932.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW

OF

# APPLIED MYCOLOGY

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ITANO (A.) & ARAKAWA (S.). **Microbiological investigation of organic manures. I. Decomposition of Rape-cake.**—*Ber. Ōhara Inst. Landw. Forsch.*, v, 3, pp. 427–446, 2 graphs, 1933.

A fully tabulated account is given of the writers' investigations on the decomposition of rape cake (*a*) in soils, and (*b*) by stock cultures of various micro-organisms. Rape cake [made from *Brassica* (?) *napus* seeds] is stated to be extensively used in Japan as a manure for tobacco, oranges, and flowering plants.

The addition of rape cake to soil caused a marked increase in the number of bacteria and a still greater increase in the number of actinomycetes present. Ammonification is thought to be brought about chiefly by the latter. Of the twelve fungi grown both in a nutrient medium and in sand, *Aspergillus cellulosae*, *A. oryzae*, *Cladosporium herbarum*, *Trichoderma koningi*, and *Rhizopus nigricans* caused the most extensive decomposition of the rape cake. The first stage in this process appears to be the production of soluble non-protein substance, which undergoes gradual conversion into ammonia culminating in 15 to 20 days, while the maximum amount of soluble total nitrogen is formed in 10 to 15 days.

WILBRINK G[ERARDA]. **Cane diseases resembling leaf scald.**—*Proc. Fourth Congress Internat. Soc. Sugar Cane Technologists*, 1932. [Abs. in *Facts about Sugar*, xxviii, 7, p. 295, 1933.]

Three sets of lesions have been observed in Java on sugar-cane which were at first mistaken for leaf scald [*Bacterium albilineans*: *R.A.M.*, xii, pp. 114, 245] but later found to represent distinct diseases. These are now known as false leaf scald, 'fourth disease' [ibid., xi, p. 4], and wilting of the 'rajoengan'; they are not uncommon on P.O.J. 2878, 2883, and 2961. False leaf scald is characterized by a chlorotic or reddish striping of the leaves, which is found on microscopic examination to be quite different from that due to true leaf scald. No causal agent has been detected and the disorder does not appear to be of economic importance.

'Fourth disease' is prevalent on the P.O.J. varieties of Kassoer extraction and combines the features of sereh, leaf scald, and root

rot. Here again the disturbance appears to be of physiological origin and of no great significance under normal conditions.

Wilting of the 'rajoengan' occurs in canes topped to stimulate the shooting of the buds for planting purposes. The disease does not seem to be transmissible and no causal organism has been found associated with it.

CROSS (W. E.). **Una misión importante de la Estación Experimental es la de evitar las epidemias en la Caña.** [An important function of the Experiment Station is to prevent Cane epidemics.]—*Rev. Indust. y Agric. de Tucumán*, xxiii, 1–2, pp. 27–31, 2 figs., 1933.

An important part of the work of the Tucumán Experiment Station consists in preventing the introduction into the Argentine Republic of epidemic diseases of sugar-cane. The only major disorder of this crop so far known to occur in the country is mosaic [*R.A.M.*, xii, p. 463], and growers are urged to co-operate with the agricultural experts in maintaining the exclusion of such dreaded scourges as gummosis [*Bacterium vascularum*], sereh disease, leaf scald [*Bact. albilineans*], and Fiji disease, chiefly by the sole use of home-grown cane for planting and the immediate notification of the Station authorities in the case of any suspicious symptoms.

TUCKER (C. M.). **The distribution of the genus Phytophthora.**—*Missouri Agric. Exper. Stat. Res. Bull.* 184, 80 pp., 1933.

This is an annotated list, arranged in alphabetical sequence of the natural order of the host, of all the species of *Phytophthora* which have been recorded in literature to occur on 216 species (in 149 genera and 67 families) of cultivated and wild plants. It also includes 82 additional species (45 genera and 6 families), on which the fungi have been successfully inoculated. Most of the *Phytophthora* species are recorded under the names reported by their authors, except when the non-validity of such names has been clearly established [cf. *R.A.M.*, x, p. 754].

The bulletin terminates with a bibliography covering 524 titles and a page index of the hosts mentioned.

WEBER (G. F.). **Occurrence and pathogenicity of Nematospora spp. in Florida.**—*Phytopath.*, xxiii, 4, pp. 384–388, 1 fig., 1933.

In 1926 *Nematospora coryli* [*R.A.M.*, xii, p. 8] was isolated from sweet pepper [*Capsicum annuum*] pods near Miami, Florida, and in 1932 the same fungus was detected on Satsuma oranges [*Citrus nobilis* var. *unshiu*] by H. S. Fawcett and on grapefruit, oranges [ibid., viii, p. 717], and tomatoes [ibid., v, p. 390] by the writer. *N. gossypii* [ibid., xi, p. 572] was isolated once from a Satsuma orange, causing exactly the same symptoms as *N. coryli*, viz., local desiccation and wrinkling of the rind, slight protrusion of the oil glands above the surface, and a whitish spotting of the locule covering, which in advanced cases may show a reddish-brown

discoloration accompanied by loss of moisture and collapse of the juice sacs.

The tomatoes infected by *N. coryli* showed 'cloudy spots' or light-coloured areas scattered over the surface. The affected tissues were somewhat pithy, as though moisture had been withdrawn and the spaces filled with air. The diseased portions ripened less rapidly than the healthy ones, leaving green islands in a green or red fruit. As the infection spreads the green spots darken, become sunken and soft, and are finally invaded by secondary soft-rotting organisms.

Cross-inoculation experiments showed that both species of *Nematospora* are pathogenic to oranges, tangerines, and tomatoes. *N. coryli* from tomato appeared to cause more rapid infection of Satsuma oranges and tangerines than the orange strain, but on tomato there was little difference in the effect of the two strains, both of which produced colonies in the seed cavities with resultant discoloration of the seeds. The multiplication of the organisms was much more rapid in tomatoes than in oranges or tangerines. The development of *N. gossypii* in tomatoes differed from that of *N. coryli* in the extensive spread of the mycelium through the host, even among the hairs of the seeds. Ascospores of both species developed profusely in diseased fruits. *N. gossypii* was less reliable in inoculation experiments than *N. coryli*.

This is stated to be the first record of *N. gossypii* in the United States, of its occurrence on orange, and of *N. coryli* on pepper in the United States.

WEHMEYER (L. E.). **The British species of the genus Diaporthe Nits. and its segregates.**—*Trans. Brit. Mycol. Soc.*, xvii, 4, pp. 237–295, 1933.

This is a systematic account of the British species of *Diaporthe*, *Diaporthopsis*, *Apioporthe*, and *Cryptodiaporthe*, and is based on a considerable collection of specimens together with such published exsiccata as have been examined by the author in preparation for his monograph of the genus *Diaporthe* [which is in the press].

In addition to a description of the perithecial stage, reference is made to any imperfect stages that have been established by cultures or have been suggested in literature.

Of the 23 recognized species of *Diaporthe*, attention should be drawn to the author's treatment of *D. eres* Nits. (the type species of the genus) which he provisionally recognizes on a number of conifers, and on some 18 genera of broad-leaved woody plants. The species, as here treated, represents some 50 specific names in systematic literature.

JENKINS (ANNA E.). **Application of the terms 'anthracnose' and 'scab' to plant diseases caused by Sphaceloma and Gloeosporium.**—*Phytopath.*, xxiii, 4, pp. 389–395, 1 fig., 1933.

The term 'anthracnose' was originated in 1853 by Fabre and Dunal for a grape disease in order to avoid the use of the word 'charbon', commonly applied in France to a cereal smut. The new name for the grape disease was used only in a symptomatic sense. The anthracnose pathogen was later described as *Sphace-*

*loma ampelinum* and is now classified in its perfect stage as *Elsinoe ampelina* [*R.A.M.*, ix, p. 66]. F. L. Scribner (*Rept. Commissioner, U.S. Dept. of Agric., 1887*, p. 323, 1888) extended the term anthracnose to denote the related bramble disease caused by *Gloeosporium venetum*, now known in its perfect stage as *E. veneta* [*R.A.M.*, xi, p. 724]. He also applied the name to the unrelated disease of beans (*Phaseolus*) [*vulgaris*] caused by *Colletotrichum lindemuthianum*, and there are various other instances in which anthracnose has been used in an etiological sense to designate disturbances due to fungi of the above-named and a few other genera [cf. ibid., x, p. 669; xii, p. 95]. Some of these diseases, both hyperplastic and non-hyperplastic, have also been called 'scab'.

It is suggested that, in naming new fungous diseases, the terms 'anthracnose' and 'scab' should be applied in a symptomatic sense, the former for necrotic and hypoplastic disorders with somewhat restricted lesions, as in bean anthracnose, and the latter for hyperplastic infections with scab-like spots, e.g., citrus scab (*Sphaceloma*) [*fawcettii*].

HIRATSUKA (N.). **Additional notes on the Melampsoraceae of Hokkaido. II.**—*Trans. Tottori Soc. Agric. Sci.*, iv, 2, pp. 111–115, 1932.

A supplementary annotated list is given of 15 fungi of the Melampsoraceae collected in Hokkaido, Japan, up to 1932 [*R.A.M.*, viii, p. 268; xi, p. 405]. *Chrysomyxa alpina* is recorded on leaves of *Rhododendron chrysanthum*.

HIRATSUKA (N.). **Studies on Uromyces fabae and its related species.**—*Japanese Journ. of Botany*, vi, 3, pp. 329–379, 2 pl., 1933.

As a result of comparative morphological studies [which are discussed in detail and tabulated] on *Uromyces fabae* [*R.A.M.*, xi, p. 431], *U. orobi*, and *U. ervi* on 13 species of *Vicia*, the three species of *Uromyces* are maintained. The hosts of *U. fabae* are *V. amoena* var. *sachalinensis*, *V. cracca* var. *japonica*, broad bean (*V. faba*), *V. japonica*, *Lathyrus maritimus*, *L. palustris* var. *lineaefolius*, and peas [ibid., x, p. 343]; those of *U. orobi*, *V. nipponica* var. *capitata*, *V. unijuga*, and *L. davidii*; and those of *U. ervi*, *V. hirsuta*, *V. sativa*, and *V. tetrasperma* [*V. gemella*].

On the basis of cross-inoculation experiments *U. fabae* was subdivided into three physiologic forms, namely, f.sp. *viciae-fabae* on broad beans and peas only, f.sp. *pisi-sativi* confined to peas, and f.sp. *lathyri-maritimi* infecting *L. maritimus* alone.

*U. orobi* falls into two physiologic forms, viz., f.sp. *viciae-nipponicae* and f.sp. *viciae-unijugae*, the former restricted to *V. nipponica* var. *capitata* and the latter to *V. unijuga*.

Cross-inoculation tests with *U. ervi* on *V. hirsuta*, *V. sativa*, and *V. gemella* (the only species liable to infection) failed to yield any evidence of physiologic specialization. This rust forms a succession of aecidia in the course of its life-cycle and from these uredosori and teleutosori may be produced in greater or lesser abundance; the uredo stage may be omitted when conditions are unfavourable.

*U. fabae* has been found very widely distributed in Japan from south Saghalien to Formosa. *U. orobi* occurs in Hokkaido, Honshû, and Shikoku, while *U. ervi* is apparently restricted to the southern districts: south Honshû, Shikoku, and Kiushû.

GADD (C. H.). **Report of the Mycologist for the year 1932.**—*Tea Res. Inst. Ceylon Bull.* 10 (*Ann. Rept. for the year 1932*), pp. 17–26, 2 graphs, 1933.

Early in the period under review witches' broom of tea [*R.A.M.*, xi, p. 749] became prevalent throughout the Kandapola district of Ceylon, followed by a marked recovery in May. In other fields the disease steadily became worse. These observations are considered to support the view that the disease indicates a derangement in the life processes of the bushes not necessarily of the same causation in every case. The witches' broom disease closely resembles yellows of tea in Nyasaland [ibid., xii, p. 537] in its secondary symptoms, but differs from it in that leaf yellowing is generally absent.

In an attempt to devise a suitable laboratory test of the disinfectant value of various paints used on wounds and pruning cuts in tea bushes (through which wood-rotting organisms effect an entry and cause unsightly cankers in the branches) blocks of wood after being soaked in water and sterilized were painted with various preparations and exposed to attack (in flasks) by *Irpex destruens* [ibid., iii, p. 4]. One set of blocks painted with each disinfectant was placed in running water for about two months before being inoculated, another was first exposed to the weather for a similar period, and the third was inoculated as soon as the paint was dry. The [tabulated] results obtained (by measuring the percentage losses in dry weight) indicated that the most effective preparations were white lead, cargillineum B [ibid., viii, p. 599], and solignum. In almost every case exposure to the weather lowered resistance more than washing and in a good many the washing was better than immediate inoculation after painting. Some improvement in the technique of the experiment is necessary before truly comparable results can be obtained.

C. (J. H.). **Tea cider.**—*Planters' Chron.*, xxviii, 5, p. 108, 1933.

Tea cider is prepared by adding about 2½ oz. of tea to 1 gall. water, bringing to the boil, and adding, when the infusion has cooled, ½ lb. sugar. The brew is then poured into an earthenware jar, a little of the tea culture [*Bacterium xylinum* and *Saccharomycodes ludwigii*: *R.A.M.*, xii, p. 249] is added, and primary fermentation is allowed to continue until the critical taste-point is reached. The period of this primary fermentation depends on climatic conditions and ranges from three or four days to (in dull weather) three weeks. At the critical taste-point, the beverage is bottled and a drop of culture added before corking. The beverage contains 3·5 per cent. alcohol, can be sold (exclusive of duty) at well under two annas [about 2*d.*] per bottle, and can be made with a wide range of sweetness.

MATSUMOTO (S.) & SOMAZAWA (K.). **Immunological studies of mosaic diseases. III. Further studies on the distribution of antigenic substance of Tobacco mosaic in different parts of host plants.**—*Journ. Soc. Trop. Agric.*, Formosa, v, pp. 37–43, 2 figs., 1933.

Continuing their studies on the distribution of the tobacco mosaic antigen in different parts of the host [*R.A.M.*, xii, p. 43], the writers performed the following experiments. The stems of twenty healthy tobacco plants, previously defoliated except for a few young leaves, were 'ringed' in the middle of an internode some way from the ground, the external tissue of the ringed lesions [presumably down to the cambium] being scraped with a red-hot scalpel; ten of the plants were then inoculated with the mosaic virus above the lesions and ten below. The results of this test showed that the antigenic substance (probably infective principle) travels freely both upwards and downwards through the lesion. In another experiment healthy tobacco plants were ringed as described above, a small square hole made through the xylem of the ringed area, and the central tissue scraped out through the hole with a red-hot knife, so that the sole organic connexion between the upper and lower portions of the plant was through the xylem ring. After 10 to 13 days, the tops of the plants inoculated above the ring exhibited distinct mosaic symptoms, though in no case was any infection observed following inoculation with the root extracts. On the other hand, where the inoculations were made below the lesion, positive results were obtained only in the tissues on the site of inoculation, neither mosaic symptoms nor antigenic reaction being apparent in the upper portions of the plant. No evidence is forthcoming, therefore, of the migration of the virus through the xylem.

In order to ascertain whether the xylem of mosaic plants ordinarily contains the antigen, the juices were separately expressed from the cortex (to the cambium), xylem, and central portion of some large mosaic plants and tested for precipitation with the immune sera. Each of the tissues was thoroughly washed in sterilized water and care was taken to avoid contamination with the virus during manipulation. From the results [which are tabulated] of these trials the authors conclude that the xylem as well as the other tissues contains the antigenic substance. A further test was carried out to determine whether the infective principle can enter the xylem directly through the unbroken cell walls or if mechanical injury of the vessels is necessary to effect penetration. Infection of the cortex, xylem, and pith was effected both through surface wounds made by rubbing and through pin pricks through the xylem, from which it appeared that the virus freely enters the uninjured xylem and passes thence into the central portion of the plant.

FUKUSHI (T.). **On some properties of the Tobacco mosaic virus: I.**—*Japanese Journ. of Botany*, vi, 3, pp. 381–392, 1933.

The tobacco mosaic virus was experimentally shown, at the Hokkaido (Japan) Botanical Institute, to be readily adsorbed by

kaolin, aluminium oxide, and aluminium hydroxide, added in the proportion of 10 to 20 per cent. to the filtered juice of diseased leaves. Aluminium hydroxide gel also proved effective as an adsorbent of the virus, whereas siliceous earth was of little value in this respect. Kaolin adsorbed the virus more readily in filtered juice with an acid reaction (below $P_H$ 6·0). The virus adsorbed by the kaolin was freed from the latter by dilute ammonia solution and regained its virulence, as shown by inoculation tests on young tobacco plants, when the solution was adjusted to a slightly acid reaction. The recovered virus gave 40 to 90 per cent. successful infections compared with 100 per cent. with the original virus in filtered juice at $P_H$ 4 to 7. The virulence of the latter was diminished by increasing the acidity or alkalinity beyond these limits.

KOSTOFF (D.). **Virus diseases causing sterility.**—*Phytopath. Zeitschr.*, v, 6, pp. 593–602, 7 figs., 1933.

Certain abnormalities of the reproductive organs, accompanied by slight modifications in growth habit, were observed at the Leningrad Academy of Sciences during the summers of 1930 and 1931 in *Nicotiana tabacum* and some of its hybrids as well as in the cross *N. paniculata* × *N. langsdorffii*. The ovaries of the affected plants were swollen and elongated, and the length of the styles much curtailed. Growth was arrested and the leaves were slightly smaller and more numerous than in healthy plants. The diseased plants (both pure line and hybrid) were sterile, even when pollinated with pollen from normal individuals, but when normal tobacco plants were pollinated with pollen from diseased ones, viable seeds were obtained that developed into normal plants.

In order to determine whether the symptoms under observation were transmissible from affected to healthy plants, a series of grafting experiments was carried out. The normal shoots of tobacco and *N. langsdorffii* grafted on affected tobacco developed the above-mentioned symptoms in 20–40 days, whereas *N. glauca* subjected to the same treatment remained apparently quite healthy. Normal tomato shoots made very poor growth on affected tobacco stocks, and therefore one scion was cut off 25 days after the initial grafting and grafted back on a healthy tomato plant, the branches of which, 20 to 25 days later, began to show definite symptoms of sterility. The floral calyces were immensely elongated, the flowers sterile, the carpels of the young fruits broke, and the seeds failed to develop; the leaves were abnormally brittle. Normal tobacco plants on which shoots from affected tobacco were grafted showed the symptoms in 25 to 35 days. Even when attacked in an advanced stage, the capsules produced non-viable seeds. Healthy *N. glauca* stocks on which diseased tobacco shoots were grafted continued to grow normally, but *N. langsdorffii* developed the typical sterility symptoms 25 to 35 days after grafting. Pronounced effects followed the grafting of affected tobacco on *D. stramonium*. In the case of *D. wrightii* and tomato stocks on which affected tobacco shoots were grafted, both stocks and scions made very poor growth but did not contract the symptoms under discussion. *N. glauca*, as mentioned above, showed no sign of sterility but was proved by grafting experiments with tobacco,

*N. rustica*, and *N. langsdorffii* shoots to carry the infective agent, which it transmitted to the scions.

No bacteria or fungi being detected in affected ovaries, the author attributes the symptom to a virus which he terms 'female sterility virus'. Similar symptoms were recently described by V. Ghimpu in a study on teratological phenomena (*Rev. Path. Vég. et Ent. Agric.*, xviii, pp. 289–295, 7 pl., 1931).

Some observations are made on the partial sterility of tobacco caused by mosaic, in which up to 48 to 50 per cent. of abortive pollen was recorded. In 1931 the writer described (*Sci. Publ. Bulgar. Agric. Soc.*, 28, p. 1) a virus disease causing sterility of plum trees through degeneration of the ovules.

STAPP (C.). **Über die experimentelle Erzeugung von Wildfeuer bei Tabak.** [On the experimental production of wildfire in Tobacco.]—*Angew. Bot.*, xv, 2, pp. 225–238, 2 figs., 1933.

A detailed account, accompanied by tables, is given of the writer's method for the artificial inoculation of tobacco with wildfire (*Pseudomonas tabaci*) [*Bacterium tabacum*] in Germany [*R.A.M.*, x, p. 629] with a view to the development of resistant varieties.

The highly susceptible selection of the Havana Original OR 44 supplied by the Genetic Research Institute, Müncheberg (Mark Brandenburg) was used for the purpose of control tests, while the Saalburger and Maurath varieties and the selection L 1924 B.R.A. were also included. Neutral beer wort agar was used as the culture medium, and inoculations with an emulsion from this source gave up to 45 per cent. infection. Even better results (95 per cent.) were attained, however, by the inoculation of young seedlings with an emulsion of the organism in the expressed sap of tobacco plants, the surface tension of which is considerably lower than that of tap water, beer wort, and various other solutions tested. The seedlings were sprayed by means of an atomizer, great care being taken to reach the under sides of the leaves. The newly infected frames must be kept at a relative humidity of 85 to 95 per cent. and a temperature of 20° to 22° C., which may be gradually adjusted to 60 per cent. and 18° to 25°, respectively.

The first chlorotic lesions appear about the sixth day after infection, or in very severe cases wilting may begin on the eighth to tenth day without any preliminary signs. Sometimes the leaves assume a transparent aspect like that of tissue paper, and in other cases the chlorosis seems to be arrested, so that the second pair of leaves develop normally and the plant survives.

GEORGEVITCH (P.). **Bakterioza slavonskich Hrastova.** [Bacteriosis of Slavonic Oaks.]—*Mitt. Inst. Forstwissensch. Forsch.*, Belgrade, *1932*, pp. 1–15, 2 pl., 1932. (Serbo-Croatian.) [Abs. in *Neuheiten auf dem Geb. des Pflanzensch.*, xxvi, 3, p. 55, 1933.]

A coccobacillus was isolated and grown in pure culture from the slimy-granular masses obstructing the vessels of the discoloured sapwood of oak trunks and roots in Slavonia (Jugo-Slavia). The foliage of diseased leaves turns yellow and shrivels. The newly discovered organism is believed to be only one of the causes of the

devastating losses among the oak plantations affected by 'dying-off' [*R.A.M.*, ix, p. 278; x, p. 277].

TEHON (L. R.) & JACKS (W. R.). **Smooth patch, a bark lesion of White Oak.**—*Journ. of Forestry*, xxxi, 4, pp. 430–433, 4 figs., 1933.

White oaks (*Quercus alba*) in Illinois are liable to show more or less extensive, smooth, apparently sunken patches of a paler grey than the rest of the bark, due to infection by *Aleurodiscus oakesii*, which has also been reported on *Ostrya virginiana*, *Carpinus caroliniana*, willows, hickories, and elms. The phloem and cambium below the lesions are not invaded, the limit of penetration of the fungus being sharply marked by a distinct blackening of the tissues. The affected areas are readily loosened from the bark and flakes of tissue drop from the tree or are torn off by the wind. Thus the thickness and inherent resistance of the natural protective layer are greatly diminished, leaving the tree exposed to the possibilities of mechanical injury and attack by wood-destroying fungi.

GRAVES (A. H.). **Forest pathology.**—*Twenty-second Ann. Rept. Brooklyn Bot. Gard., 1932* (*Brooklyn Bot. Gard. Record*, xxii, 2), pp. 57–63, 1 fig., 1933.

Further notes are given on the experiments in progress on the hybridization of the Japanese chestnut (*Castanea crenata*) with the American (*C. dentata*) and a variety of *C. sativa*, with a view to developing a race resistant to blight [*Endothia parasitica*: *R.A.M.*, x, p. 566].

MORRIS (R. T.). **A hitherto unreported blight of the Juglandaceae.**—*Phytopath.*, xxiii, 4, pp. 407–408, 1933.

In the writer's arboretum at Stamford, Connecticut, a hitherto apparently unreported blight attacked the anthers of a number of Juglandaceae in 1932, the species affected including the English walnut (*Juglans regia*, Webb variety), butternut (*J. cinerea*) with its hybrids and parthenogens, five cultivated varieties of the black walnut (*J. nigra*), several of the Japanese (*J. sieboldii*), *J. sinensis*, *J. sibirica*, pecan (*Hicoria* [*Carya*] *pecan*), and *H.* [*C.*] *ovalis*. The anthers were attacked when almost ready to shed pollen and on any given tree were often blackened and destroyed in a single night though sometimes the process extended over two or three nights. G. P. Clinton, plant pathologist at the Connecticut Agricultural Experiment Station, expressed the opinion that the disease was bacterial in origin. Towards the end of August, when the walnut trees should have been laden with nuts, many bore no fruit at all while others had a few clusters apparently resulting from local pollination.

SCHUSTER (C. E.) & MILLER (P. W.). **A disorder of Persian (English) Walnuts grafted on Black-Walnut stocks, resulting in girdling.**—*Phytopath.*, xxiii, 4, pp. 408–409, 1933.

Since 1924 Persian (English) walnuts [*Juglans regia*] of the Franquette variety grafted on black walnut (*J.* [*californica* var.]

*hindsii*) in the Willamette Valley, Oregon, have suffered from a disorder characterized by poor shoot growth, premature defoliation, and girdling at the graft union preceded by the development of water-soaked, chocolate-coloured spots in the bark of the stock below. The affected trees usually die about three years after the first symptoms are observed on the aerial parts. The newly formed xylem tissues of the English scion apparently fail to unite with those of the stock, and a dark layer of corky consistency, up to $\frac{1}{4}$ in. thick, is formed between the two kinds of wood, the entire circumference of the tree being finally involved. The disturbance is evidently of a physiological character since no infectious micro-organisms have been found in the discoloured tissues.

FINCH (A. H.) & KINNISON (A. F.). **Pecan rosette: soil, chemical, and physiological studies.**—*Arizona Agric. Exper. Stat. Tech. Bull.* 47, pp. 407–442, 12 figs., 1933.

A fully detailed and tabulated account is given of the writers' studies on pecan [*Carya pecan*] rosette [*R.A.M.*, xii, p. 339] in Arizona, where the disease was found not to be correlated with the total soluble salt content or hydrogen-ion concentration of the soil. Somewhat variable symptoms characterize the disturbance in different varieties: leaf 'burning' or die-back being commonly observed in Success, Schley, Stuart, and others; chlorosis and crinkling in Burkett; while chlorosis and malformations with little burning are typical of affected Kincaid, Halbert, and Moneymaker. Rosette has been present in Arizona for over twenty years, leading to the abandonment of pecan orchards in the Santa Cruz, Casa Grande, Salt River, Mohawk, Safford, and South Gila valleys.

Severely rosetted trees produced healthy growth following the injection of soluble zinc salts (chloride and sulphate) in a dry form into holes in the trunk at the rate of 2 to 4 gm. per hole, as well as by similar treatment with a 1 per cent. solution of zinc chloride. An improvement was also noticeable in the condition of young leaves dipped in zinc chloride or zinc sulphate at varying strengths up to 1 per cent., some benefit also being derived from iron sulphate used in the same way, possibly due to its 1 per cent. zinc content [cf. ibid., xii, p. 99]. Chemical analyses revealed the following total zinc and iron contents in healthy and rosetted trees, expressed in percentages of dry matter: (1) healthy, Yuma valley, 0·0356 zinc, 0·1509 iron; (2) healthy, South Gila valley, 0·00203 and 0·01565; (3) treated, South Gila valley, 0·00278 and 0·03511; (4) rosetted, same locality, 0·00035 and 0·05450. The topmost parts of a healthy tree in an area where rosette is prevalent contained less zinc than those from a comparable tree in a district essentially free from the disease. It was further ascertained that zinc is present in the irrigation waters of areas free from rosette, and absent from those in which the disease is serious. The zinc treatments were most efficacious on trees making rapid growth, and their success on older ones is questionable; in such cases pruning of the upper parts to stimulate new growth may be necessary.

TOGASHI (K.) & UCHIMURA (K.). **A contribution to the knowledge of parasitism of Valsa paulowniae, in relation to temperature.** —*Japanese Journ. of Botany*, vi, 3, pp. 477–487, 4 graphs, 1933.

Studies were made on the pathogenicity of *Valsa paulowniae* to *Paulownia tomentosa* with reference to the temperature relations of the fungus under natural conditions in northern Japan.

The minimum, optimum, and maximum temperatures for the growth of the fungus in culture were found to be below 5°, 22° to 27°, and 30° to 32° C., respectively; above the optimum the growth increments promptly decreased, whereas at lower temperatures (above 10°) development became more profuse with age. *V. paulowniae*, therefore, like *V. japonica* [*R.A.M.*, xi, p. 60], evidently flourishes at low temperatures, in contrast to the relatively thermophilous *V. mali* [ibid., iv, p. 612] and *Leucostoma persoonii.*

In northern Honshû and in Hokkaido *V. paulowniae* causes a serious die-back of *P. tomentosa*, the temperature fluctuations in the tissue of which exactly coincide with the requirements of the fungus. *V. paulowniae* has also been reported from the more southerly regions of Japan, but the conditions there are not so favourable for its development and spread.

GARD (M.). **Quelques points d'histoire relatifs à la maladie du Pin maritime (Pinus pinaster Sol.). Programme d'expériences.** [Some historical data concerning the disease of Maritime Pine (*Pinus pinaster* Sol.). Programme of experiments.]—*Rev. Path. Vég. et Ent. Agric.*, xx, 3, pp. 128–133, 1933.

From a review of the work so far done on the serious dying-off of maritime pines (*Pinus pinaster*) [*P. maritima*] in the south and south-west of France the author concludes (*a*) that it is of fungal origin, and (*b*) that the spread of the disease is effectively prevented by deep trenches dug around existing centres of infection. Many points in the etiology of the trouble are as yet obscure, however, and a plan is outlined for the further study of the disease, with particular reference to the locally observed relationship of outbreaks with fire injury to the trees.

LACHMUND (H. G.). **Method of determining age of blister rust infection on Western White Pine.**—*Journ. Agric. Res.*, xlvi, 8, pp. 675–693, 1 fig., 1933.

In this paper the author suggests a method for determining the age of different infections of the western white pine (*Pinus monticola*) with blister rust (*Cronartium ribicola*) [*R.A.M.*, xii, p. 341]. The rust infests the bark of the host through the needles, and in the Pacific Northwest most of the needles of any one year's formation are shed at the end of the fourth season, although some needles may persist for five and a few for as long as eight seasons. While, therefore, infection of the bark may conceivably occur on internodes of any age up to eight years, it is obvious that by far the largest number of infections take place on internodes not over four years old. There was evidence that in the region investigated conditions favourable for heavy needle infection are generally

limited to a short period in any one season, and occur, on the average, about every third season. Observations showed that while the incubation period of the rust following needle infection varies in individual cases, the first discoloration or visible swelling of the bark that marks the incipient canker appears only under exceptional conditions in the first season following that of infection: such incipient cankers appear chiefly in the second season, to a lesser degree in the third season, and to a negligible extent, if at all, in subsequent seasons. The distribution of cankers resulting from an infection wave is characteristic; of 5,879 cankers from distinct infection waves of five different years in 14 different localities less than 10 per cent. occurred on growth of the season of infection, over 53 per cent. on that of the following season, over 31 per cent. on growth one year older, about 5 per cent. on fourth year's growth, while the percentages on still older growth were practically negligible. Most of the cankers in each wave are approximately the same age and result from the same season's infection.

A comparison with this typical distribution pattern, of comprehensive records, made from an infection area, of cankers classified according to stage of development and the year's growth affected, will generally permit an accurate determination of the main infection years and provide a reliable guide to the progress of the rust in that area.

NEFF (P.). **Shall we protect Western White Pine from blister rust?**—*Journ. of Forestry*, xxxi, 3, pp. 286–295, 6 graphs, 1 diag., 1933.

On the basis of average selling prices during the past ten years the writer concludes that a stumpage return of $200 to $300 per acre may reasonably be expected from the good western white pine (*Pinus monticola*) stands of Idaho. The fall in the price of *P. monticola* (16 per cent. of the average price for 1928–30) was less than that for *P. ponderosa* (25 per cent.) and mixed species (35 per cent.) and the author considers that a systematic campaign against blister rust [*Cronartium ribicola*: see preceding abstract] would be fully justified in the State.

LANGNER (W.). **Ueber die Schüttekrankheit der Kiefernnadeln (Pinus silvestris und Pinus strobus).** [On the leaf fall disease of Pine needles (*Pinus silvestris* and *Pinus strobus*).] —*Phytopath. Zeitschr.*, v, p. 6, pp. 625–640, 3 figs., 4 graphs, 1933.

A full account is given of the writer's observations during 1931–2 at the Dresden Technical College, Tharandt, on the infection of pine (*Pinus sylvestris* and *P. strobus*) needles by *Lophodermium pinastri* and *Hypoderma brachysporum* [*H. desmazierii*: [*R.A.M.*, ix, p. 227; xii, p. 254, *et passim*].

The mycelia arising from monospore cultures of *L. pinastri* on malt agar differed so widely in colour, ranging from pure white to brownish, and in reciprocal attraction or aversion, as to suggest the occurrence of heterothallism. On sterilized dead needles of *P. sylvestris* the leaf fall fungus produced pycnidia but no

apothecia; on sterilized living needles it failed to grow. *L. pinastri* was isolated in a number of cases from the yellow, brown, and purple lesions on one-year-old needles preceding the actual leaf fall, as well as from the typical 'golden' spots on older needles, for which it is evidently responsible. *Dematium* [*Pullularia*] *pullulans* [ibid., x, p. 514; xi, p. 30] was also isolated with fair regularity from the diseased needles, but its part in the causation of the spotting is not clear. The mycelium of *L. pinastri* proved extremely resistant to high temperatures, withstanding ten minutes' exposure to 95° C. The fungus also resisted the complete desiccation of the branches for a short period, but failed to survive three years' preservation under dry conditions.

Pine needles infected by *L. pinastri* were found to give off more water than healthy ones, so that their fall cannot be attributed to a disorganization of the water balance following a dry spell. On the contrary, the desiccation of the branches associated with leaf fall is a direct consequence of infection.

The mycelium of *H. desmazierii* formed pycnidia and apothecia on sterilized dead needles, but failed to grow in the laboratory on living ones.

YAMAMOTO (W.) & ITO (T.). **Studies on the white pocket rot or 'renkon-kusare' of Chamaecyparis formosensis Mats.**—*Trans. Nat. Hist. Soc. Formosa*, xxii, pp. 433–442, 1932; xxiii, pp. 44–54, 1 pl., 1933. [Japanese, with English summary.]

*Chamaecyparis formosensis*, an important tree in the virgin forests of Formosa, is stated to suffer from a white pocket rot of the heartwood caused by *Stereum sulcatum*, known as an agent of a similar disease of conifers in North America. The fungus forms elongated lesions on the living trunk and twigs, filled with a white, fibrous mass of decomposed tissue; at an advanced stage the fibrous masses disappear, leaving hollows. Both the lignin and the middle lamella of the cell wall are dissolved.

Among the best media for the growth of *S. sulcatum* are onion, oatmeal, and 'koji' extract agar. No development occurred on substrata to which 0·2 to 0·1 per cent. tannic acid was added, and very scanty growth with an admixture of 0·05 per cent. The optimum temperature for the growth of the fungus on onion agar was found to lie between 22° and 25° C., with a maximum at 31° to 34°, development being more profuse at 16° than at 31°.

AGGARWAL (K. L.). **Fomes annosus on Deodar.**—*Indian Forester*, lix, 4, pp. 239–242, 1933.

*Fomes annosus* is stated to be widespread on the deodar [*Cedrus libani* var. *deodara*] plantations of the Seraj Forest Division, where climatic conditions are not altogether suitable for this tree. The affected poles assume a sickly aspect, the crowns becoming attenuated and the needles turning pale, while resin is exuded from the stem. The roots are rotten, spongy, and covered with the white mycelium of the fungus. *F. annosus* is steadily spreading from old to new regeneration areas, and attempts have been made to check its development by means of deep isolation trenches.

This method, however, has been only partially successful and is in any case too costly (over Rs. 25 [£1 17*s*. 6*d*.] per acre during the period from 1927–31) for general use. With advancing age the trees appear to manifest some degree of resistance to the fungus, so that excessive damage from this source is not anticipated, especially in healthy sites and with an admixture of spruce.

NISIKADO (Y.) & YAMAUTI (K.). **Contribution to the knowledge of the sap stains of wood in Japan. I. Studies on Ceratostomella ips Rumbold, the cause of a blue stain of Pine trees in western Japan.**—*Ber. Ōhara Inst. Landw. Forsch.*, v, 3–4, pp. 501–538, 12 pl., 1933.

A comprehensive and fully tabulated account is given of the writers' investigations, conducted at the instance of the Local Forestry Bureau of Osaka, on the sap stains of pine (*Pinus densiflora* and *P. thunbergii*) which are stated to be prevalent and very injurious, causing the death even of standing trees, in the plantations of western Japan. Among the numerous species of *Ceratostomella* and *Graphium* associated with the diseased material, *C. ips* [*R.A.M.*, xi, p. 341] was constantly found in the blue-stained sapwood of living pine roots, and was readily obtained in pure culture on malt extract agar. In the districts near the coast of the 'Inland Sea' in Hyôgo and Osaka Prefectures *C. ips* was found in connexion with infestation by bark beetles (*Ips* spp.).

The dark to blackish-brown, pluriseptate hyphae, 4 to 8 $\mu$ in width, occur in the medullary rays, resin ducts, and tracheids, into which they penetrate through the bordered pits. The discoloration is at first wedge-shaped and gradually extends uniformly over the surface. The obovate to elliptical or cylindrical conidia are borne in heads on brown conidiophores measuring 90 to 100 by 5 to 8 $\mu$ at maturity. The conidia fall into two groups as regards length, viz., a small type 3 to 9 $\mu$ long (mean $4{\cdot}82 \pm 0{\cdot}045\ \mu$) and a large type 7 to 18 $\mu$ (mean $11{\cdot}42 \pm 0{\cdot}097\ \mu$), the width of both groups being fairly uniform (1·5 to 4 $\mu$, mean $2{\cdot}58 \pm 0{\cdot}015\ \mu$). Secondary condidia, 3 to 6 by 1·5 to 3 $\mu$, are formed on the tips of the germ-tubes or on the conidia themselves. The black, flask-shaped perithecia are without setae and measure 120 to 240 $\mu$ (mean $177{\cdot}8 \pm 2{\cdot}69\ \mu$) in height by 110 to 250 $\mu$ (mean $179{\cdot}6 \pm 3{\cdot}10\ \mu$) in diameter, with a beak (devoid of the fimbriate appendages typical of the genus) 80 to 400 $\mu$ long (mean $215{\cdot}0 \pm 7{\cdot}60\ \mu$) by 30 to 50 $\mu$, or up to 1,540 $\mu$ long in culture. The rapidly diffluent asci are apparently elliptical, ovoid, or irregular, with eight mucilaginous, hyaline, cylindrical ascospores with truncated ends, giving a rectangular aspect under the microscope, 3 to 6 by 1·5 to 3 $\mu$; on germinating, the ascospores swell and the ends become round, the characteristic *Cephalosporium*-like conidia developing within two days in malt extract solution.

On standard media, the colour of the colonies ranges from hyaline or milk-white to black. The minimum, optimum, and maximum temperatures for mycelial growth were found to be 6° to 8°, 27° to 29°, and 35° C., respectively; conidial formation takes place throughout the range of development, being most profuse at

27° to 31°. The optimum temperature for perithecial production on sterilized pine or oak blocks appears to be from 27° to 29°. The conidia succumbed to ten minutes' exposure to a temperature of about 52°. Neither mycelial growth nor conidial formation occurs in the absence of free oxygen.

FINDLAY (W. P. K.). **The germination of the spores of Merulius lacrymans (Wulf.) Fr.**—*Trans. Brit. Mycol. Soc.*, xvii, 4, pp. 334–335, 1 fig., 1933.

The author obtained germination of fresh spores of *Merulius lacrymans* after six days at about 20° C. on 8 per cent. malt agar plus 1 per cent. malic acid or 1 per cent. phosphoric acid; the germination was delayed in many spores, but at the end of the experiment, when overgrowth of the mycelium prevented further observations, approximately a quarter of the spores had germinated. Germination was also observed on a medium made up of an old autoclaved culture of *Coniophora cerebella* mixed with fresh malt agar, the reaction of which was distinctly acid, whilst a few spores germinated on untreated Sitka spruce [*Picea sitchensis*] and beech wood. The difficulties experienced by some previous workers in germinating spores of *M. lacrymans* are believed to have been due to the fact that they used spores that were no longer fresh.

SANBORN (J. R.). **Production of parchment-like membranes from cultures of slime-forming microörganisms.**—*Indus. & Engin. Chem.*, xxv, 3, p. 288, 1933.

The species of *Oidium* and *Monilia* isolated from pulp and paper mill slimes in the United States [*R.A.M.*, xii, p. 545] were found to develop profusely in media with a high carbohydrate content, producing doughy and somewhat rubbery growths. Suitable substrata are potato decoction or ground-wood extract, with the addition of glycerol, dextrin, or glucose. Satisfactory transparent parchment-like membranes have been produced from these slime growths by comminution of the material in water, deposition of slime particles on the sheet-forming substratum by means of an aspirator, lubrication of the resultant membrane by a glycerol and mineral oil treatment, and desiccation in a steam hot-plate sheet drier.

SANBORN (J. R.). **The formation of semi-transparent membranes from cultures of slime-producing micro-organisms.**—*Science*, N.S., lxxvii, 1994, p. 290, 1933.

Some further details are given of the methods developed at the laboratory of the International Paper Company, Glens Falls, New York, for the production of transparent parchment-like sheets from cultures of the slime-forming organisms (*Monilia* and *Oidium* spp.) occurring in pulp and paper mills [see preceding abstract.]

MOTTE (M. H.). **La hernie du Chou.** [The finger-and-toe disease of Cabbage.]—*Journ. d'Agric. Prat.*, N.S., xcvii, 9, pp. 177–178, 1933.

The writer's observations on finger-and-toe disease of crucifers

(*Plasmodiophora brassicae*) in Denmark are summarized. Black mustard [*Brassica nigra*] is practically immune from infection while charlock [*B. sinapis*] is severely damaged, its roots being covered with swellings. Among the cultivated crucifers, red cabbage is the most resistant, followed by the smooth-leaved white and Savoy, while cauliflower, Brussels sprouts, and the non-heading types of cabbage are more susceptible. Table varieties of turnip are more susceptible to infection by *P. brassicae* than those used for fodder. The latter frequently show aerial lesions, indicating that infection does not occur exclusively through the root hairs. The most resistant turnip varieties are the Funen Bortefelder and Norwegian May. Swedes suffer more severely than turnips from the attacks of *P. brassicae*, which rapidly involves the whole root. Wallflowers [*Cheiranthus cheiri*] are moderately susceptible.

Finger-and-toe is most prevalent in light soils and in dry seasons, and in the early stages of infection the plants are temporarily stimulated to abnormally rapid and luxuriant growth. Some indication of biologic specialization in *P. brassicae* was given [cf. *R.A.M.*, xi, pp. 16, 277]. The form from charlock appears to be specially well adapted to growth on the turnip.

Five years' experiments in the control of *P. brassicae* by the application of lime and potash gave inconclusive results. Practically no attempt is made to combat the disease on a large scale in Denmark, but market-gardeners appear to keep it within bounds by complete abstention from the use of organic manure. Septennial crop rotation is recommended in infected land.

WALKER (J. C.). **Yellows-resistant lines of Jersey Wakefield Cabbage.**—*Journ. Agric. Res.*, xlvi, 7, pp. 639–648, 2 figs., 1933.

Continued studies of the inheritance of resistance to cabbage yellows (*Fusarium conglutinans*) in the Jersey Wakefield variety [*R.A.M.*, ix, p. 694] confirmed the existence of a single factor difference between plants highly resistant or highly susceptible to this disease. It was shown that when a commercial line of this variety was planted on infected soil, it was possible to isolate homozygous resistant pure lines from the resistant survivors, and that such lines continued to be completely resistant in succeeding generations. The work also demonstrated the possibility of combining resistance with the more important type characters of this variety without having recourse to repeated back crossings with the susceptible stock, although this procedure may have to be adopted when it becomes necessary to accumulate in the resistant lines the genes controlling the desirable market characters.

NEILL (J. C.). **Production of disease-free Swede seed. Preliminary trials under the small-farm plan.**—*New Zealand Journ. of Agric.*, xlvi, 4, pp. 207–210, 1933.

The author states that the two main diseases of swedes in New Zealand, responsible for the steady decline in that Dominion of the area annually sown to this crop, are dry rot [*Phoma lingam*: *R.A.M.*, xii, pp. 134, 481] and finger-and-toe [*Plasmodiophora

*brassicae*: ibid., xii, p. 412]. Investigations have shown that dry rot, a seed-borne disease, may be economically controlled by sowing seed from healthy plants on land which has not carried a diseased crop for the two previous years and which is removed from the neighbourhood of swedes or turnips grown from infected seed, while finger-and-toe can be practically controlled by the use of certain resistant varieties or strains of swedes, if certain precautions are taken in sowing.

On the basis of these results a plan is outlined for the production of main crop swede seed from plants grown from mother seed sown during the preceding autumn. Since experiments indicated that the best results are obtained by raising the seedlings on special nursery beds and transplanting them to the final position for seeding, it is projected in preliminary trials to grow the seedling plants at the Plant Research Station from dry-rot-free mother seed selected and bred at the Station, and to distribute them to three growers for planting out in June and July, so that the seed crop may be harvested the following January or February. Should this initial experiment be successful it is believed possible to create a new industry under expert official supervision, which is likely not only to save New Zealand the £60,000 now spent annually abroad for swede seed, but also to become a profitable source of export, besides reducing the enormous financial losses that are caused every year by the seed-borne diseases of the crop.

WALKER (J. C.) & SNYDER (W. C.). **Pea wilt and root rots.**—*Wisconsin Agric. Exper. Stat. Bull.* 424, 16 pp., 2 figs., 2 graphs, 1933.

Popular notes are given on the following diseases affecting peas in Wisconsin: wilt (*Fusarium orthocerus* var. *pisi*), 'near wilt' [*R.A.M.*, xii, p. 548], and the root rots caused by *Aphanomyces euteiches*, *F. martii* var. *pisi*, *Rhizoctonia* (*Corticium vagum*) [*C. solani*], *Ascochyta pinodella*, and *Mycosphaerella pinodes* [ibid., xii, p. 483]. Wilt has been found to yield only to the cultivation of resistant varieties [a list of which is given: ibid., xii, p. 412], while the root rots require special cultural measures, including heavy fertilizing, crop rotation, thorough drainage, and the use of clean seed from the dry regions of the mountain States.

MEYER-HERMANN (K.). **Neue Wege zur Bekämpfung der Herz- und Trockenfäule der Rüben.** [New methods for the control of heart and dry rot of Beets.]—*Deutsche Landw. Presse*, lx, 16, p. 194; 17, p. 205, 4 figs., 1933.

Excellent results have been obtained in the Cassel district of Germany against heart and dry rot of beets (Eckendorf fodder) by the application to the soil of borax at the rate of 20 kg. per hect., as recommended by Brandenburg in Holland [*R.A.M.*, xii, p. 2]. In one test covering an area of 12·5 ares the increased yield due to the treatment was estimated at 282 doppelzentner of beets per hect., the approximate cost being M. 8 per hect. Moreover, the sugar content of the treated plants was considerably higher than that of the controls.

MATZULEVITCH (B. P.). Болезни Лука. [Onion diseases.]—*Всесоюз. Госуд. Объединение по борьбе с вредителями и болезнями в Сельском и Лесном Хоз.* [*Pan-Soviet State Assoc. Control of Pests and Diseases in Agric. and Silvic.*], Leningrad, *Publ.* 10, 24 pp., 1932. [Received June, 1933.]

In the first part of this pamphlet the author gives very brief descriptions of the more important diseases of onion prevalent in Russia, namely, downy mildew (*Peronospora schleideni*) [*R.A.M.*, xii, p. 484]; leaf mould (*Macrosporium parasiticum*) [ibid., x, p. 499]; smut (*Urocystis cepulae*) [see next abstract]; white rot (*Sclerotium cepivorum*) [ibid., xi, p. 219]; pink root rot caused by *Fusarium cepae* [ibid., x, p. 795]; grey mould (*Botrytis allii*) [ibid., ix, p. 82]; and a disease, chiefly of seedlings, characterized by an excessive brittleness of the leaves and roots, with the formation on the latter of swellings. In this disease, the cause of which is believed to be an undetermined species of *Fusarium*, most of the plants attacked fail to develop and rot.

The remainder of the pamphlet consists of instructions to local phytopathologists on the methods to be employed in making reports to central authorities, and of recommendations for control.

EVANS (R. I.). **Cytological studies on the parasitic relationship of Urocystis cepulae to the Onion.**—*Amer. Journ. of Botany*, xx, 4, pp. 255–268, 2 pl., 1933.

In a study of penetration of the fungus into Southport Red Globe onion seedlings experimentally infected by *Urocystis cepulae* [*R.A.M.*, v, p. 646; *et passim*] in Wisconsin, no indications were found of appressoria, or of any sort of anchorage of the fungus to the host epidermis. The wall beneath the cuticle is apparently dissolved away by a secretion produced by the infection hypha and judging from the bulging of the innermost layers of the wall inwards a certain amount of pressure is exerted by the hyphal tip. Neither cytological nor morphological changes were observed in the invaded epidermal or subepidermal host cells. True haustoria were not detected, but these organs were simulated by the dichotomous branches arising from the epidermal mycelium and penetrating the subepidermal cells.

As the onion plant approaches a condition of immunity with the maturing of the cotyledonary tissues, the lesions contracted during this transitional period become progressively less conspicuous, though there is no apparent decrease in their numbers. At the same time the hyphae that have succeeded in penetrating the epidermal cells of the host show increasing signs of distortion, and the attainment of absolute immunity by the host coincides with the complete degeneration of the fungus. Irregular structures which the author terms 'subcuticular vesicles' were constantly observed in the outer epidermal wall of onions on the verge of immunity from infection, and are thought probably to be composed of fungus mycelium which has digested a place for itself in the cell wall, representing an attempt on the part of the host to inhibit the passage of the invading fungus into the epidermal cell.

McHargue (J. S.) & Calfee (R. K.). **Further evidence that boron is essential for the growth of Lettuce.**—*Plant Physiol.*, viii, 2, pp. 305–313, 6 figs., 2 graphs, 1933.

In a previous report (*Plant Physiol.*, vii, p. 161, 1932) the writers showed that the exclusion of boron from the mineral nutrient solution in which lettuce of several varieties was grown resulted in a severe deficiency disease, characterized by malformation of the more rapidly growing leaves, spotting and burning of the tips, and death of the growing point. A similar condition of lettuce was described by Stone and Smith in 1897 as 'top burn' and attributed to unfavourable surroundings, but Le Clerg was unable to establish a correlation between temperature and tipburn [*R.A.M.*, xii, p. 197].

The writers' experiments at the Kentucky Agricultural Experiment Station showed that the burning of lettuce leaves is preventable by the addition to the nutrient medium of boric acid [cf. ibid., xii, p. 2], boro-silicate (powdered Pyrex glass), or the borates of potassium, sodium, calcium, manganese, copper, or zinc at the rate of 0·4 to 0·9 p.p.m. boron; at higher concentrations (1·0 to 2·5 p.p.m.) the compounds were definitely injurious to the plants, and above the latter strength fatal.

The boron content of normal lettuce plants was found to range between 25 and 50 p.p.m. of the moisture-free tissues, some degree of deficiency being shown by those containing less than 20 p.p.m., while signs of toxicity were apparent where the boron content exceeded 50 p.p.m. The concentration of boric acid in the leaves of the test plants was found to depend on that of soluble boron in the solution, indicating a correlation between the latter and the rate of absorption by the plant. Boro-silicate proved to be the most satisfactory compound for incorporation in sand cultures.

Buddin (W.) & Ware (W. M.). **Clitocybe dealbata as an invader of Mushroom beds.**—*Gard. Chron.*, xciii, 2415, pp. 246–248, 4 figs. (1 on p. 249), 1933.

Attention is drawn to a severe outbreak of *Clitocybe dealbata* on indoor and outdoor mushroom [*Psalliota campestris*] beds near Petersfield, Hampshire, in February, 1933 [*R.A.M.*, xi, p. 493]. The parasite was apparently introduced with a truckload of dung in September, 1930, since when it had steadily spread from house to house and to the adjacent outdoor beds, until finally all the floors, soil, and compost were found to be permeated by the coarse, white mycelium and clumps of white sporophores. The systematic position and morphology of *C. dealbata* are briefly discussed, with special reference to its separation from *C. candicans*, which is never fasciculate. Notes are given on previous outbreaks in England and France and control measures are recommended based on the replacement of infected beds by fresh material, and on general plant sanitation.

Uppal (B. N.). **India: diseases in the Bombay Presidency.**—*Internat. Bull. of Plant Protect.*, vii, 5, pp. 103–104, 1933.

The following are among the plant diseases newly recorded for the first time in the Bombay Presidency: *Peronospora trigonellae*

on *Trigonella foenum-graecum* (first report for India); *Sclerotium rolfsii* on *Cannabis sativa*; *Cercospora rosicola* on rose [*R.A.M.*, ix, p. 613]; and mosaic on *Helianthus annuus* and *Momordica charantia*.

ADAMS (J. F.). **Report of the Plant Pathologist for 1932.**—*Quart. Bull. State Board of Agric., Delaware*, xxiii, 1, pp. 3–16, 1 graph, 1933.

Continuing his annual reports on the health of crops in Delaware [*R.A.M*, xi, p. 560; cf. also xii, p. 267], the author states that in 1932 dipping sweet potato sprouts in semesan bel [ibid., x, p. 363] increased the yield by 27 bushels, and gave freedom from scurf [*Monilochaetes infuscans*] (as against 14 per cent. infection in the control plants) and only a trace of black rot [*Ceratostomella fimbriata*]. Dipping the sprouts in a dilution of four ounces improved semesan bel in 2 gall. water, on the other hand, while giving complete control of the two diseases, reduced the yield by 28 bushels.

Observations on the relationship between the primary infection of apple trees with scab (*Venturia inaequalis*) and the efficacy of sprays indicated that the possibility of obtaining practical control of the disease is favoured when the major maximum discharge of the ascospores occurs before blossoming, this opinion being based on the fact that as tree growth advances, the total leaf area exposed to infection progressively increases, thus lowering the relative potential efficacy of the sprays.

Among the other crop diseases recorded, mention may be made of the discovery of leaf spot (*Cercospora daizu*) [ibid., xi, p. 87] on soy-beans in the Seaford section, this being the first record of the fungus for Delaware.

**Plant pathology.** [*ex* Experiment Station Summary Report of Progress 1932.]—*Maine Agric. Exper. Stat. Bull.* 363, pp. 274–294, 5 figs., 1932. [Received July, 1933.]

In the part of this report dealing with degeneration diseases of Green Mountain potatoes it is stated that yield tests made during the period from 1918 to 1932 in north-western Maine showed that with 100 per cent. mild mosaic the yield was reduced by 10 to 33 per cent., with an average of 21 per cent. In central Maine it was found that a distance of half a mile from the nearest virus-diseased potatoes was not sufficient to prevent invasion of the crop by leaf-roll carriers in 1931. Further experiments indicated that the aphid *Macrosiphum solanifolii* [*M. gei*] cannot transmit latent mosaic, which is present in a masked condition in most of the important American commercial varieties of potato, to healthy Green Mountain seedlings, though various other viruses that were present mixed with the latent virus in the diseased plants were readily transmitted by this insect.

*Botrytis cinerea* was isolated from a rot of stored potatoes, and the rot was experimentally reproduced under certain conditions by various cultures of this fungus, including some that were isolated from potato leaves and stems during an epidemic of *B. cinerea* in

the field. In Aroostook County late blight [*Phytophthora infestans*] was very severe and caused losses estimated at 10 per cent. of the crop; this was partly due to the financial depression which caused many growers to make fewer spray applications than normal. The potato spray service, started in 1931, has greatly increased in popularity in the county, 311 farmers, with 2,605 acres of potatoes, co-operating in it in 1932. Under these severe late blight conditions 10–10–100 Bordeaux mixture gave perfect control of the disease, and the yield obtained from plots treated with it was significantly superior to that from plots treated with home-mixed copper-lime dust (25 lbs. monohydrated copper sulphate to 75 lbs. hydrated lime); 5–5–100 Bordeaux mixture applied with a power machine also gave good control but was less efficient than the full strength towards the latter part of the season. Continued tests of the potato variety known locally as Rust Proof showed that under the extremely severe conditions in 1932 this variety was very resistant both to foliage blight and tuber rot due to *P. infestans*. It yielded in unsprayed plots 117 barrels per acre with no decay, while comparable plots of Green Mountains yielded 45 barrels per acre with 48 per cent. decay. Potatoes in Maine were also severely attacked in 1932 by *Rhizoctonia* [*Corticium solani*], which caused considerable losses in the form of uneven stands. Preliminary laboratory and field experiments indicated that the addition of 0·25 per cent. potassium iodide to a 1 in 1,200 mercuric chloride solution considerably increased the fungicidal efficacy of the latter when used as a tuber dip for the control of *C. solani*.

In spraying tests on McIntosh apples the addition in 1932 of 0·75 lbs. iron sulphate to 50 gallons of dry lime-sulphur spray in three applications gave a significant decrease in leaf scorch and a significant increase in yield; it also resulted in a better control of scab [*Venturia inaequalis*] and in a reduction of fruit russeting as compared with lime-sulphur alone.

Inoculations of young fir (*Abies balsamea*) needles with teleutospores of the blueberry (*Vaccinium corymbosum* and *V. pennsylvanicum*) witches' broom fungus (*Calyptospora columnaris*) [*R.A.M.*, x, p. 532] resulted in the formation on them of aecidial pustules from the twelfth day onward, with 100 per cent. infection in 16 days. On blueberry plants sprayed in April with aecidiospores from the fir, witches' brooms began to appear in three months' time but discontinued growth until the onset of cool weather in October. It is believed that the incubation period of the witches' broom stage in blueberry under natural conditions lasts approximately one year.

**Plant diseases.** [*Ex* Facts for farmers. Annual Report of the Director Wisconsin Agricultural Experiment Station 1931–1932.]—*Wisconsin Agric. Exper. Stat. Bull.* 425, pp. 96–112, 5 figs., 1933.

A number of the items in this report have already been noticed from other sources, but the following may be mentioned. Field experiments by J. C. Walker and L. M. Blank on the onion bulb rotting caused by *Fusarium* spp. indicated that two out of the

five cultures used as inocula were highly pathogenic to the red, yellow, and white varieties, viz., *F. zonatum* form 1 from Wisconsin and Illinois [*R.A.M.*, xi, p. 421] and *F. cepae* [ibid., xii, p. 135] from Wisconsin and Colorado. Organic manure increased this disease as compared with commercial fertilizers.

W. H. Pierce and J. C. Walker found that the Robust or yellow strain of bean [*Phaseolus vulgaris*] mosaic [ibid., xi, p. 561 and next abstract] is transmissible by the pea and potato aphids [*Macrosiphum pisi* and *M. gei*] but not seed-borne. It is capable of infecting soy-beans, broad beans [*Vicia faba*], and tepary beans [*P. acutifolius* var. *latifolius*], crimson clover [*Trifolium incarnatum*], and sweet clover [*Melilotus alba*]. M. C. Parker's and R. A. Brink's genetical studies on common bean mosaic have shown that in crosses between highly resistant and very susceptible types, e.g., Robust and Stringless Green Refugee, more than half (56 per cent.) the progeny in the $F_2$ generation are resistant when Robust is the female parent, while nearly all (98·7 per cent.) are susceptible in the reciprocal cross. Evidently, therefore, the inheritance of resistance is non-Mendelian, and the fact that it is transmitted mainly through the female line suggests that the governing factor is carried in the cytoplasm. Breeding experiments are in progress to test the validity of this hypothesis.

Leaf spot of cherries [*Coccomyces hiemalis*], a very destructive disease in the Door peninsula, was effectively combated in G. W. Keitt's and E. C. Blodgett's tests on the Montmorency variety by three applications of Bordeaux mixture or 1 in 40 lime-sulphur (1) when three-quarters of the petals had fallen; (2) a fortnight later; and (3) after harvest [ibid., x, p. 741 *et passim*]. Four treatments with colloidal sulphur ($1\frac{1}{2}$–50) or flotation sulphur (5–50) [ibid., xii, p. 577] failed to give comparable results. The two last-named preparations were also ineffectual against apple scab [*Venturia inaequalis*].

Good control of oat smut [*Ustilago avenae*] was obtained by J. G. Dickson, B. D. Leith, and W. H. Tharp in tests with formaldehyde dusts containing 7 per cent. or more of formaldehyde [ibid., vii, p. 159; x, p. 373; xi, p. 634]. The yields in the plots so treated were equal to those secured by the application of the more expensive volatile mercury dusts.

J. G. Dickson found that the smooth-awned barley Pedigree 38 maintained its resistance to stripe disease (*Helminthosporium gramineum*) [ibid., xi, p. 560], contracting less than 0·5 per cent. infection in 18 fields compared with 2·9 and 12·7 per cent. in 14 and 16 fields of Oderbrucker Pedigree 6 and Velvet Minnesota, respectively. Loose smut of barley [*U. nuda*] has proved amenable to control by a modified hot water treatment consisting in four hours' immersion at 90° F., followed by 13 minutes at 126° to 128° with subsequent rapid cooling and drying. Barley scab [*Gibberella saubinetii*] is reported to have caused heavy losses in Illinois and Iowa, but in Wisconsin it was largely prevented by cutting the stalks after harvest for silage or fodder and thorough ploughing under all remaining refuse. Feeding experiments indicated that hogs should not be given barley containing over 10 per cent. scabbed kernels [ibid., x, p. 651].

**Plant pathology.** [*Ex* Work and progress of the Agricultural Experiment Station for the year ending December 31, 1932.] —*Idaho Agric. Exper. Stat. Bull.* 197, pp. 45–48, 1933.

Seed potato virus diseases have been reduced to a minimum in Idaho by the practices of tuber indexing and tuber uniting [*R.A.M.*, xii, p. 50].

Favourable results have again been obtained with the mosaic-resistant U.I. No. 1 selection of the Great Northern bean [*Phaseolus vulgaris*] variety [ibid., ix, p. 229; xii, p. 414].

For three years seven lucerne varieties have been grown in three widely separated localities where wilt [*Aplanobacter insidiosum*] occurs in a severe form. During 1932 marked differences were apparent in the yielding capacity and reaction to wilt of these varieties, common lucerne being the most satisfactory in both respects, followed by Cossack and Ladak, while Grimm and Hardigan were unproductive and very susceptible [ibid., xi, p. 787].

The powdery mildew of clover [*Erysiphe polygoni*] has been shown to be transmissible from alsike [*Trifolium hybridum*] to red clover [*T. pratense*] and vice versa [ibid., xi, p. 246; xii, p. 78]. The perfect stage of the fungus, however, is produced only on the former host.

Heavy damage has been caused for a number of years in the mountainous region of Sandpoint by snow scald of wheat and barley, due to a fungus believed to be identical with *Typhula graminum*, a culture of which has been obtained from Japan [ibid., ix, p. 709] for comparison.

**Serving California agriculture. Report of the California Agricultural Experiment Station July 1, 1931, to June 30, 1932.** —106 pp., 8 figs., 6 diags., 1933.

The following items of phytopathological interest, in addition to those already noticed from other sources, occur in this report. 'Black end' of pears [*R.A.M.*, xii, p. 574] resulted from grafting on Japanese stocks (*Pyrus serotina*), for which French pear stocks or quince stocks should be substituted.

An extensive die-back and leaf scorch of prunes in the Sacramento Valley is attributed to potassium deficiency coupled with excessively heavy bearing.

Of 38 varieties and strains of lucerne tested for resistance to wilt [*Aplanobacter insidiosum*: see preceding abstract], Ladak and a number of Turkestan strains have given encouraging results.

Sulphur having proved injurious to cantaloupe vines in spraying tests against powdery mildew [*Erysiphe cichoracearum*: *R.A.M.*, xi, p. 28], a selected strain of Persian melon resistant to this type of damage has been distributed to growers for trial in Imperial and Riverside counties.

Tomato, pepper [*Capsicum annuum*], and eggplant were found to be susceptible to artificial inoculation with potato calico [ibid., xi, p. 320], the transmissibility of which by at least one insect has been established.

In preliminary tests chlorine and nitrogen trichloride proved

effective against the moulds contaminating disinfecting boxes, belts, and other equipment in citrus packing houses.

VERONA (O.). **Une observation sur l'action pathogène du Bacterium tumefaciens Smith et Townsend.** [An observation on the pathogenic action of *Bacterium tumefaciens* Smith et Townsend.]—*Boll. Sez. Ital. della Soc. Internaz. Microbiol.*, v, 5, pp. 139–140, 1933.

When *Bacterium tumefaciens* was added to pots containing *Vicia faba* plants growing in Knop's solution the secondary roots and tap-roots after a few days developed a brown discoloration which gradually spread to the collar, stem, branches, and the main and secondary veins of the leaves, the bacterium slowly becoming diffused through the plants, obstructing the vessels and causing necrosis of the tissues at certain points where it became localized. As *Bact. tumefaciens* is not infrequently present in the soil, some importance is attached to this observation of its ability to produce vascular necrosis.

BORGHARDT (A. I.). **Основы построения системы мероприятий по ликвидации головни в зерновом производстве СССР.** [Basic principles underlying the measures proposed for the total elimination of smuts from cereal crops in USSR.]—*Bull. Plant Protection*, Leningrad, Ser. II (*Phytopath.*), *1932*, No. 2, 79 pp., 18 figs., 1932. [Received June, 1933.]

In an editorial preface this paper (written in 1930) is stated to have served as a basis for the measures which were adopted by the Pan-Soviet Smuts Conference in 1931 for the effective control in Russia of cereal smuts, and more particularly of wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*]. It opens with a discussion of the causes which, in the author's opinion, underlie the failure of the control measures hitherto employed both in Russia and abroad (chiefly lack of co-ordination and standardization of the methods) and which, he believes, may be easily obviated in a country where co-operative action on the Soviet lines is enforced. Stress is especially laid on the wastefulness of the old methods owing to the haphazard application of the treatments or disinfectants, without regard to the degree of contamination of the seed-grain, but mainly to the fact that hitherto each grower has had to treat, to obtain full control, the whole of his seed material, whereas this would be unnecessary if grain from a clean crop could be secured. This may be done by separating the production of cereal seed-grain from the commercial growing of the crops, entrusting it to special bodies whose business it would be to supply the growers within their area with clean seed. According to his calculations only 15 per cent. of the total seed requirements of the whole country need be disinfected every year.

A detailed discussion, based on many years of experiments and observations in Russia, is given of the various methods of seed treatment [all well known] for the control of the chief cereal smuts which are divided into three groups, namely, (*a*) wheat bunt (*Tilletia tritici*) [*T. caries*], rye bunt (*T. secalis*) and stripe smut (*Urocystis occulta*), *Panicum miliaceum* smut (*Ustilago panici-

*miliacei*), *Setaria italica* smuts (*U. crameri* and *U. neglecta*) [*R.A.M.*, v, p. 174], sorghum smuts (*Sphacelotheca cruenta*, *S. sorghi*, *Ustilago bulgarica* [ibid., viii, p. 339], and *U. sorghicola* Speg.), and sorghum and maize smut (*Sorosporium reilianum*) [ibid., xii, p. 563], all of which are amenable to control by liquid, semi-liquid, or dust seed treatment; (*b*) loose wheat smut (*U. tritici*), covered and loose barley smuts (*U. hordei* and *U. nuda*), and covered and loose oat smuts (*U. kolleri* and *U. avenae*), amenable to treatment of the seed-grain by heat; and (*c*) maize smut (*U. zeae*), which is not controllable by seed treatment. Particularly effective in the control of the first group of smuts where contamination of the grain is not excessive, is stated to be the dust preparation AB [ibid., xii, p. 559], owing to the fineness of its structure and to its adhesiveness; it consists of 36 per cent. copper carbonate ($2CuCO_3 . Cu(OH)_2$), 56 per cent. gypsum, and 8 per cent. Paris chalk. Its commercial preparation is described in detail in an appendix. The dust is stated to have a neutral reaction, preventing it from corroding the metallic parts of seed drills, and its light specific gravity renders it much easier to apply than the ordinary copper carbonate dusts; 1 kg. of this preparation is sufficient to treat 640 kg. of wheat, and its cost is much lower than that of the commercial copper carbonate. Good results were also obtained with chrompik [loc. cit.] which is stated to be a preparation of potassium bichromate, and calcium arsenate ($Ca_3As_3O_6$); the last-named substance is stated, however, to have a very depressing effect on the germination of wheat, and should not be used at doses higher than 1 gm. per kg. of seed-grain.

The paper also contains an illustrated description of several apparatus for liquid, semi-liquid, and dry treatment of the seed-grains, among which preference is given to the Russian machines 'Pobieda', a dusting apparatus with a capacity of 12 cwt. grain per hour, constructed by P. M. Davydoff; 'AB-1', a combined apparatus for liquid, semi-liquid, and dust treatments, constructed by the author, with a capacity of 15 cwt. per hour; and 'Niloff 2', a similar but larger apparatus constructed by the Scientific Research Laboratory for Poisons [Leningrad], with a capacity of 150 cwt. per hour. Mention is also made of two recent German apparatus constructed by Gebr. Röber and by Kalker Trieurfabrik for use with their Petkus [ibid., vii, p. 436] and Kraft grain-cleaning machines; and finally of a combined grain-cleaning and treating machine on wheels constructed by the Neuhaus-Eberswalde Works in Germany.

The paper terminates with a table in which the relative efficacy of 39 fungicides is shown by figures representing the averages for several years of the percentage infection in crops raised from treated and untreated seed, the smuts considered being *T. caries*, *U. hordei*, *U. kolleri*, *U. avenae*, and *U. panici-miliacei*.

GAINES (E. F.) & SMITH (W. K.). **Reaction of varieties and hybrids of Wheat to physiologic forms of bunt.**—*Journ. Amer. Soc. Agron.*, xxv, 4, pp. 273–284, 1 diag., 1 graph, 1933.

Eleven autumn-sown and 15 spring wheat varieties were used in the differentiation of five physiologic forms of *Tilletia tritici*

[*T. caries*] and at least two of *T. levis* [*T. foetens*] obtained from bunt collections in the Pacific Northwest [*R.A.M.*, xii, p. 204]. The reactions of 27 winter wheats, including the chief commercial varieties of the area in question, to single cultures and mixtures of these forms are described and tabulated.

Hohenheimer is highly resistant to physiologic forms T2 and L4 (T = *T. caries* and L = *T. foetens*) to which White Odessa is quite susceptible, while both are moderately resistant to T11. The seed obtained from each $F_2$ plant of a cross between Hohenheimer and White Odessa was divided into three parts, one of which was inoculated with T2, another with L4, and the third with T11. The factor in Hohenheimer governing strong resistance to T2 was found to be responsible for a similar reaction to L4, and for the moderate resistance of this variety to T11. In the reaction of progenies to the last-named strain, well-marked transgressive segregation was apparent, some being much more resistant and others much more susceptible, than either parent. The moderate resistance of White Odessa to T11 was found to be determined by a single main factor different from that inducing resistance in Hohenheimer.

BRENTZEL (W. E.). **Physiologic specialization of Tilletia tritici on Emmer.**—*Phytopath.*, xxiii, 5, pp. 483–485, 2 figs., 1933.

*Tilletia tritici* [*T. caries*] is destructive on Yaroslav emmer (*Triticum dicoccum*) in North Dakota, where natural infection by *Tilletia levis* [*T. foetens*] on this wheat has not been observed by the writer, though artificial inoculations were successful. From a critical study of four collections of *T. caries* on emmer and 146 on durum wheat it appeared that the spores of the former were quite distinct from the latter, being uniform in size, almost spherical, and more regularly bearing well-developed reticulations. The smut balls developing on Ceres wheat from inoculations with each of the emmer forms were much elongated, whereas those from ten durum collections were rounded. The average percentage of smutted Ceres heads from the emmer inoculations was only 24, compared with 85 from the durums. In field tests the emmer smuts produced low percentages of infection on ten common wheats and relatively high ones on emmer, while with the durum collections the position was reversed. The four collections of emmer smut appear to belong to one physiologic form.

NILSSON (E.). **Paralleles Auftreten von Tilletia-Infektion und Speltoidcharakter bei Triticum vulgare.** [The correlation between *Tilletia* infection and speltoid character in *Triticum vulgare*.]—*Hereditas*, xviii, 1–2, pp. 262–268, 3 figs., 1933.

In 1930 the writer examined 20 Standard wheat ears infected by bunt (*Tilletia*) [? *caries*: *R.A.M.*, viii, p. 767] at Eslöv, Sweden. One of the ears contained a single healthy grain, which was sown in the autumn and produced a completely healthy plant. Immediately after the 1931 harvest the grains of this plant were heavily infected with *Tilletia* spores and sown in an experimental plot at a distance of 10 cm. apart. An inspection of the 34 plants

surviving the winter showed that six bore exclusively speltoid ears, three a mixture of normal and speltoid, one had normal, speltoid, and 'mosaic' (representing both types in a mosaic-like distribution), one normal and mosaic, and three speltoid and mosaic, the remainder being normal. Soon after tillering it was observed that all the speltoid and 'chimera' ears were severely attacked by bunt, from which those of the normal type remained free.

It is considered from these investigations, as well as from previous observations of a similar phenomenon, that a definite correlation exists between the speltoid character and infection by bunt, but further studies are necessary, and have already been initiated, to elucidate the connexion between cause and effect. In the meantime several possible theories are advanced. The mother plant of the series (that arising from the single healthy grain in a bunted ear) may have been an ordinary, homozygous, normal plant without complications; the speltoid character of some of the progeny would then have been directly due to the bunt attack, possibly involving the elimination of a *C* chromosome. Or the development of the speltoid character may have been the opening phase of a 'mass mutation', to which the bunt invasion was a sequel. Possibly, too, the mother plant may have been heterozygous for the speltoid character and have segregated into the above-mentioned types; or again, it may have been a chimera in which the speltoid components were entirely concealed ('cryptochimera'). In this case also the fungus may either have caused the speltoid development or selected for preference the ears deviating from the normal type.

SCOTT (R. C.). **Rust in Wheat crops in South Australia, season 1932–33.**—*Journ. Dept. Agric. S. Australia*, xxxvi, 10, pp. 1144, 1146–1147, 1933.

The author states that the chief reason for the 1932–3 South Australian wheat crop failing to give the record yield that had been anticipated was attack by red rust (*Puccinia graminis*). In respect of resistance the two outstanding varieties were Ford and Sword, which in practically all stands ripened good quality grain. Gluyas, hitherto regarded as very resistant, was badly affected.

RADULESCU (E.). **Zur physiologischen Spezialisierung des Weizenbraunrostes (Puccinia triticina Erikss.).** [On physiologic specialization in brown rust of Wheat (*Puccinia triticina* Erikss.).]—*Kühn-Arch.*, xxxiii, pp. 195–205, 1933. [Abs. in *Plant Breeding Abstracts*, Imper. Bureau of Plant Genetics, iii, 3, p. 103, 1933.]

Forty-nine collections of brown rust (*Puccinia triticina*) were examined, of which 37 originated in Rumania [*R.A.M.*, xii, p. 426], and the rest in Germany, Sweden, Finland, and Greece. From the 37 Rumanian cultures ten forms were isolated, eight of which have previously been found in Europe, 13 and 20 being the most frequent. The determination of the forms from other countries agrees with that made by Scheibe [ibid., ix, p. 767]. Form 15 was isolated from Greek material.

LOWIG (E.). **Über den Einfluss des K-Ions und der Kalisalz-Anionen auf die Widerstandsfähigkeit der Getreidearten gegen den Befall von Erysiphe graminis.** [On the influence of the K-ion and of the potash salt anions on the resistance of cereals to attack by *Erysiphe graminis.*]—*Ernähr. der Pflanze*, xxix, 9, pp. 161–165, 9 figs., 1933. [English summary on p. 179.]

A tabulated account is given of the writer's investigations, at the Bonn-Poppelsdorf Agricultural Institute, on the effect of potash fertilizers on mildew of cereals (*Erysiphe graminis*) [*R.A.M.*, xii, p. 362]. In the summer of 1930 pot experiments were initiated with the semi-resistant Janetzki and the moderately susceptible Peragis wheat varieties, grown in a mixture of 89 per cent. sand, 1 per cent. peat mould, and 10 per cent. of soil from a plot receiving no potash for 25 years. Supplemental to an adequate basal dressing of nitrogen and phosphoric acid, the plants were given potash in the form of the chemically pure sulphate, chloride, and silicate (0·5 or 1 gm. per pot). Similar experiments were made in the autumn with the winter varieties, Hopetown and Michigan Bronze. In the spring of 1932 the tests were extended to oats and barley in addition to summer wheat, the citrate and carbonate also being used as sources of potash.

It was found that the wheat and barley plants receiving insufficient potash were uniformly infected by *E. graminis*, mostly in such a severe form that scarcely any ears were produced. Liberal applications of potash in any available form resulted in a marked decline in the incidence of mildew, combined with an augmented yield, these effects being most noticeable with the silicate. No mildew was observed on the oats used in the tests, and these plants failed to respond significantly to the potash treatments—a fact interpreted as showing that the beneficial effects on wheat and barley production are an indirect sequel to the prevention of mildew.

The microscopic examination of the treated plants showed a pronounced thickening of the cell membranes, especially the outer ones of the epidermal cells, in the silicate series, accompanied by a heavy ash deposit. These features were not apparent to any significant extent in the carbonate and citrate series. The thickening of the membranes is believed to be the direct cause of the increased resistance of the plants to mildew.

PUGH (GRACE W.), JOHANN (HELEN), & DICKSON (J. G.). **Factors affecting infection of Wheat heads by Gibberella saubinetii.**—*Journ. Agric. Res.*, xlvi, 9, pp. 771–797, 10 figs., 2 graphs, 1933.

Continuing their studies on the wheat ear blight caused by *Gibberella saubinetii* [*R.A.M.*, xii, p. 159] the authors give a full report of their field and greenhouse inoculation experiments between 1920 and 1924, the results of which showed that infection was most effective (on pure lines of Marquis and Prelude wheats, which were almost exclusively used) when the ears were sprayed with a conidial suspension of the fungus while blossoming or just after this period, although some infection also resulted from earlier

or later applications. The length of the incubation period was shortest at the higher end of the range of controlled temperatures (from 12° to 32° C.) tested, and also decreased as the plants matured. The fact that, in inoculations made before the blossoming period, the great majority of initial infections occurred in the spikelets that were first to open in the ear, and that infection spread further usually in the same order as that in which other spikelets opened up, is interpreted to indicate that the fungus gains entry through the floral parts rather than that it progresses in the ear through the rachis. It is thought that infection most usually occurs through the anthers or other degenerating tissues, on which the fungus first develops as a saprophyte and from which it spreads to the interior of the flower and to the developing grain. This view is supported by the fact that infection was frequently observed to begin in anthers that had failed to emerge from the glumes, and that a high percentage of the spikelets showing initial infection were found to have retained anthers in them. Retention of the latter is not, however, dependent on infection, since in Marquis wheat the percentage of retained anthers was found to be higher in healthy than in infected ears. There was no evidence that initial infection occurs through the outer surface of the glumes.

PADWICK (G. W.) & HENRY (A. W.). **The relation of species of Agropyron and certain other grasses to the foot-rot problem of Wheat in Alberta.**—*Canadian Journ. of Res.*, viii, 4, pp. 349–363, 4 figs., 1933.

During the summer of 1932 a survey was made of several districts in central Alberta to determine the incidence of wheat foot-rotting organisms on grasses. *Helminthosporium sativum*, *Ophiobolus graminis* [*R.A.M.*, xi, pp. 169, 291–294; xii, p. 18], *Colletotrichum* sp.. and *Fusarium* sp. were isolated from *Agropyron repens*; *O. graminis, H. sativum*, *F.* spp., and a fungus resembling a *Leptosphaeria* from *A. tenerum*; *H. sativum* and *F.* sp. from *Bromus inermis*; and *H. sativum* from *A. richardsonii.* The heaviest infestation was on *A. repens* (practically 100 per cent.), followed by *A. tenerum* (64·3 per cent.), while *B. inermis* showed only 29 per cent. foot rot. It was shown by inoculation experiments [the results of which are tabulated] that the strains of *O. graminis* and *H. sativum* isolated from grasses are equally pathogenic to Marquis wheat with those from the wheat itself. Under certain conditions the strains of *Fusarium* obtained from grasses would probably also attack wheat, but in the tests under discussion they were not highly pathogenic, with the possible exception of the *A. repens* strain.

Artificial inoculation of the various grasses was made by infestation of the soil with strains of *O. graminis*, *H. sativum,* and *F. graminearum* [*Gibberella saubinetii*] from wheat. The [tabulated] results of the experiments showed that all the 12 species of *Agropyron* used in the tests were susceptible to *H. sativum* and also (except one, which was not exposed to infection) to *O. graminis.* Both fungi further attacked *B. inermis* and *B. ciliatus,* while *H. sativum* also infected oats slightly and *O. graminis* was

parasitic on *Hordeum jubatum*. *G. saubinetii* killed a high percentage of the seedlings before emergence, the species affected being oats, *A. elongatum*, *A repens*, *B. inermis*, and *B. ciliatus*.

In an experiment to determine the relation of *A. tenerum* to the amount of take-all in the following wheat crop, it was found that the latter showed 4·8 per cent. infection by *O. graminis* after this grass, whereas none was present in the crops succeeding brome, timothy (*Phleum pratense*), lucerne, or summer fallow. Other wheat foot-rotting organisms also appeared to be more prevalent after *A. tenerum*, the importance of which in this connexion is evidently considerable.

PITTMAN (H. A.). **Barley smuts and their control.**—*Journ. Dept. Agric. Western Australia*, 2nd Ser., x, 1, pp. 2–8, 3 figs., 1933.

After briefly distinguishing between the symptoms of loose smut (*Ustilago nuda*) and covered smut (*U. hordei*) of barley and stating that while the former is not, apparently, very prevalent in Western Australia, the latter is often very abundant in crops grown from untreated seed, the author recommends formalin sprinkling as the cheapest effective method yet devised for the control of covered smut: directions are given for applying this and other well-known treatments.

HOLTON (C. S.). **Studies in the genetics and the cytology of Ustilago avenae and Ustilago levis.**—*Minnesota Agric. Exper. Stat. Tech. Bull.* 87, 34 pp., 21 pl., 1932. [Received July, 1933.]

This is the full report of the author's investigation of hybridization between *Ustilago avenae* and *U. levis* [*U. kolleri*], excerpts from which have already been noticed [*R.A.M.*, xi, p. 37; xii, p. 431]. In addition to the information previously given it is stated that artificial inoculations on Anthony, Liberty Hull-less, and Victory oat seedlings with crosses between monosporidial lines of *U. avenae* produced both the loose and covered smuts, while *U. kolleri* only produced the covered smut. Inoculations with crosses between the two species produced both the loose and the covered, and also intermediate types of smut. It was found, further, that one cross may produce the loose and covered smut on one and the same variety of oat or the loose smut on one variety and the covered smut on another or, on the other hand, the same type of smut may be produced by it on as many as three different varieties.

While the production during the investigation of the new buff type of smut [loc. cit.] is considered to indicate the possibility of the formation of new physiologic forms of the oat smut fungi, the fact that sporidia isolated from germinating hybrid smut spores were non-culturable except in very rare cases would tend to show that the likelihood of this process occurring in nature is very remote. There was no definite evidence of mutation either in *U. avenae* or *U. kolleri*, and the variants which appeared as sectors in cultures of monosporidial lines are interpreted as being the result of segregation.

In the brief section dealing with the cytology of the two fungi it is stated that the sporidia, the promycelial cells, the primary

sporidium, and the mycelium in monosporidial cultures of both species are uninucleate. Attempts to stain fusing sporidia were unsuccessful, but according to a statement in an unpublished thesis by Allison fused sporidia initiate the dikaryophase, which is binucleate, and which persists throughout the parasitic stage to the production of smut spores which, when mature, have a single diploid nucleus.

PICHLER (F.). **Der Schneeschimmel. Ursachen und Abwehr seines Auftretens.** [The snow mould. Causes and prevention of its occurrence.]—*Fortschr. der Landw.*, viii, 7, pp. 149–153, 2 figs., 1933.

Four types of cereal fusariosis are recognized by the writer as a result of protracted observations in Austria, namely, (1) attack on the seedlings during germination and emergence; (2) the development of a white, later reddish mould on the winter crops after the melting of the snow; (3) foot root of the haulm base between flowering and ripening; and (4) infection of the seed in the ear at the same time. Of these, only form (2) can correctly be diagnosed as the 'snow mould' due to *Fusarium nivale* [*Calonectria graminicola*], the others being better collectively grouped as 'fusarioses' irrespective of the specific identity of their agents [*R.A.M.*, xii, p. 278].

The fact that disinfection of the seed-grain is by no means an infallible remedy against the snow mould points to soil infection as an important factor in the development of the disease [ibid., xi, p. 228].

The following recommendations, based on the writer's observations and those of other workers, are made for the control of the snow mould by the avoidance of conditions under which it flourishes. Only absolutely healthy seed-grain of appropriate varieties should be planted. It has been noticed that plants raised from seed originating in high, cold situations thrive on the plains, and that those from shaded regions do well on exposure to sunshine. Generally speaking, varieties deficient in dextrose are resistant to snow mould. The use of large, heavy seed-grain of high germinability is essential; it should be treated before sowing with a standard fungicide (preferably by immersion, which enables the inferior seed-grain to be floated off). Late sowing, fairly wide spacing, shallow cultivation, thorough tillage, and good drainage are all important measures. Potash and phosphoric acid should be applied in the autumn, but nitrogen should not be given (unless seriously deficient in the soil) until after the snow melts in the spring. Where the snow persists for lengthy periods it should be broken up by driving over the field or making holes with sticks, and the melting accelerated by strewing ashes.

TASUGI (H.). **Studies on the physiology of the conidiophores, conidia and oospores of Sclerospora graminicola (Sacc.) Schroet. on the Japanese Millet (Setaria italica (L.) Beauv.) (Studies on Japanese Peronosporales II.).**—*Journ. Imper. Agric. Exper. Stat.*, Nisigahara, Tokyo, ii, 2, pp. 225–262, 3 pl., 1 fig., 5 graphs, 1933. [Japanese, with English summary.]

After pointing out that *Sclerospora graminicola* is common on

*Setaria italica* in Japan and Korea, where it is also found on *S. viridis* [*R.A.M.*, x, p. 24], the author states that field observations showed that in fine weather the conidiophores and conidia are always produced on *S. italica* at night, but when light rain falls (or even in fine weather if the affected plants are kept in bell-jars indoors), sporulation occasionally takes place during the day. Affected *S. italica* leaves kept at about 20° C. in a moist chamber near a window produced spores in every case during daylight, so that presence of light is not a limiting factor for the development of the conidiophores and conidia. The conidiophores matured 50 minutes to 2 hours after appearing on the leaves in a moist chamber, while the conidia required a further 1 to $2\frac{1}{2}$ hours; the total time that elapsed between the placing of the leaves in the chamber and the maturation of the conidia amounted to 4 to $8\frac{1}{2}$ hours.

The optimum temperature for the development of the conidiophores and conidia lay between 18° and 20·5°, while the maximum and minimum were, respectively, 35° and 5°.

The conidiophores vary in size and structure according to the temperature and the stage of growth reached by the host. When the plant is very young they are usually short and simple, but as the summer approaches they become larger and more complex; by harvest-time they assume a very complex structure and the length reaches its maximum, being almost double the corresponding measurement in spring. They are small, simple, and regular at temperatures ranging from 5° to 15°, become larger and more complex at 18° to 23°, and at 26° to 30° they are even more so, but are somewhat malformed, occasionally producing knob-like masses of mycelium without conidia.

The conidia vary so considerably in size that sometimes they scarcely seem of the same species. They are small in spring, but gradually enlarge, reaching their maximum size in the middle of August, after which they shrink to the same size as they had in spring. These variations in size appear to be correlated with seasonal temperature. The width to length ratio is high when the conidia are small, but decreases as they become larger.

When the mature conidia are sown in tap water they germinate immediately and liberate 1 to 8 (generally 3 to 4) zoospores. The encysted zoospores measure 9 to 12 $\mu$ in diameter. Under unfavourable conditions, such as at temperatures of 5° to 9° or 28° to 30°, or when they are too young or too old, the conidia may germinate only occasionally, and produce germ-tubes instead of zoospores. The optimum temperature for conidial germination is 17·5°, and the minimum and maximum are about 5° and 33·5°, respectively. Near the optimum temperature, the conidia germinate in about one hour, or even less at temperatures slightly above, while at 9° and 5° some germinated after 30 and 72 hours, respectively. They lose their germinating power soon (within 40 minutes) after the disappearance of the film of water from the leaves.

A sufficient supply of free oxygen is essential for oospore germination and a simple method of securing this is described. The oospores germinate 30 to 48 hours after being sown, producing

only a single germ-tube. Germination to the extent of 14·3 per cent. was obtained three days after collection, and 68·6 per cent. after 45 days. The optimum, minimum, and maximum temperatures for oospore germination are, respectively, 20° to 23·5°, about 11·5°, and about 35°. At $P_H$ 2·9 or 3·1 oospore germination is abundant, gradually decreasing as the $P_H$ value rises, until at $P_H$ 9·3 it is very scanty. Exposure to dry heat (50°) for periods ranging from 30 minutes to 4 hours greatly reduced oospore germination (36 and 9·3 per cent., respectively, as compared with 42·7 per cent. in the controls); exposure to wet heat (50°) for periods ranging from 1 to 4 hours inhibited germination. After exposure to 60° dry heat for 10 minutes to one hour very few oospores germinated, and after longer exposures none. Hot water treatment at 60° inhibited germination after 10 minutes.

Oospores treated for 10 minutes with 0·01 per cent. mercuric chloride gave only 12 per cent. germination, no germination occurring when 0·05 or 0·1 per cent. solution was used for the same period. Treatment for 10 minutes to 4 hours with 0·05 and 0·1 per cent. copper sulphate gave a very low percentage of germination, while after exposure for 2½ to 4 hours to 0·5 per cent. copper sulphate no germination occurred.

When stored in dry conditions the oospores continued to germinate readily until the following spring, after which germinative power declined; it ceased 500 to 600 days after collection.

NIKOLAIEFF (V. A.). Микробиология болезней хлеба. [Microbiology of the diseases of bread.]—Pamphlet issued by *Всесоюзн. Научно-Исслед. Инст. Хлебопекарной Промышл.* [*Pan-Soviet Scientific Res. Inst. Bread-baking Indus.*], Leningrad, 48 pp., 18 figs., 1932. [Received July, 1933.]

By far the greater part of this pamphlet is given to a discussion of the troubles of bacterial origin that develop in badly stored wheat and rye bread, with a detailed description of the morphological and cultural characters of the organisms, and a few recommendations for their control. Besides that due to *Micrococcus* [*Bacillus*] *prodigiosus*, a red discoloration of the crumb is also caused by *Oidium aurantiacum* [*Neurospora sitophila*] and *Thamnidium aurantiacum*, both of which are stated to be innocuous to man. Among the fungal troubles described mention may be made of a 'chalky' condition of both wheat and rye bread crumb caused by two fungi first described by Lindner in 1908, namely *Endomyces fibuliger* and *Monilia variabilis*; and of various common moulds, among which *Penicillium glaucum*, *Aspergillus glaucus*, and *Rhizopus nigricans* are stated to be the most widespread.

JENKINS (ANNA E.) & FAWCETT (H. S.). **Records of Citrus scab mainly from herbarium specimens of the genus Citrus in England and the United States.**—*Phytopath.*, xxiii, 5, pp. 475–482, 1 fig., 1933.

The result of the examination of phanerogamic herbarium specimens of *Citrus* in England and the United States support the view that citrus scab (*Sphaceloma fawcettii*) [see above, p. 595] originated and was present in the Orient at an early date. A

Javanese specimen dated 1840 appears to constitute the earliest specimen record of the disease, though Tanaka refers to a mention of it in Japan in an unpublished manuscript written by Y. Murase in 1818 [cf. *R.A.M.*, iii, p. 269].

The present known range of citrus scab appears to be considerably wider than was reported in 1926 by Fawcett and Lee [ibid., v, p. 735], the disease occurring in eastern and southern Asia, Oceania, Australia, New Zealand, Africa, the United States, the West Indies, Mexico, the Canal Zone, and South America. It is stated that Fawcett obtained infection at 24·5° and 27·5° C. in a test in which the infection period was prolonged, so that the occurrence of scab under natural conditions at these temperatures is evidently not precluded [cf. ibid., v, p. 420].

MAIRE (R.), FOËX (E.), & MALENÇON (G.). **Sur l'étiologie du bayoud, maladie du Palmier Dattier.** [On the etiology of the baïoud disease of the Date Palm.]—*Comptes rendus Acad. des Sciences*, cxcvi, 19, pp. 1349–1350, 1933.

At the instance of the Moroccan (French Protectorate) Government, the writers investigated the 'baïoud' disease of date palms (*Phoenix dactylifera*) in different localities. Following the detection of the conidia of *Cylindrophora albedinis* [*R.A.M.*, x, p. 654] in the vascular tissues of infected palms in the Tafafilet area, similar observations were made at Tinifift and Bou-Denib. The organism is most abundant at the bases of the rachids, especially in cases of recent attack. At this point no reddening is apparent; on the contrary, the parenchyma surrounding the vessels assumes a translucent aspect, so that the surface of the affected area looks whitish and opaque, with scattered water-soaked spots. In the early stages of infection the mycelium is confined to the vascular and fibrous tissues, and the conidia are sometimes formed in such profusion as to obscure the cavity of the large vessels. The parenchyma is not invaded until much later, and in this tissue conidial production is much more sparse. Any of the cavities arising in the tissues through various processes are liable to be filled with conidia, a fact that readily explains the spread of the disease from tree to tree, e.g., by pruning implements and possibly by insects.

The examination of very recent cases of baïoud showed that infection originates at the leaf bases and spreads rapidly upwards in the bud, progress towards the trunk and in a transverse direction being slower. In this way fresh vascular areas are continuously involved in the infection, the leaves are successively destroyed, and the tree dies with the invasion of the vascular tissues of the terminal growing point. The disease may be described as a tracheomycosis. A high degree of tolerance is manifested by the Khalt variety.

MAIRE (R.) & MALENÇON (G.). **Le belaât, nouvelle maladie du Dattier dans le Sahara algérien.** ['Belaât', a new disease of the Date in the Algerian Sahara.]—*Comptes rendus Acad. des Sciences*, cxcvi, 21, pp. 1567–1569, 1933.

The writers recently investigated a disease locally known as

'belaât' or 'suffocation' of date palms (*Phoenix dactylifera*) in the Biskra and Oued-Rir districts of Algeria presenting certain superficial analogies with 'baïoud' [*Cylindrophora albedinis*: see preceding abstract]. Both disorders are characterized by a white discoloration of the leaves which in 'belaât', however, attacks the entire central bunch of leaves at once instead of beginning with a single subterminal leaf, as in 'baïoud'. Moreover, in the new disease the whole leaf is affected from the onset, whereas *C. albedinis* may long be restricted to one side. Recovery sometimes occurs by the production of a new shoot from a subterminal bud. The disease is much less serious than 'baïoud' and occurs chiefly in neglected plantations.

Recently infected palms show a rapidly progressing, wet heart rot originating near the growing point. The more or less lignified tissues immediately below the decayed terminal bud assume a uniform vinaceous tint and undergo progressive delignification until their final transformation into a greenish-yellow mass of caseous consistency, saturated with water. The diseased tissues have a pronounced odour of acetic and butyric fermentation. The decay of the trunk extends downwards with diminishing intensity, forming a sort of inverted cone sharply delimited from the healthy tissues by a narrow brown zone. This process results in the asphyxiation and decomposition of the terminal bud and of the bases of the surrounding leaves, which become discoloured. The reddish-brown lines found in the rachids of palms affected by 'baïoud' are absent from those attacked by 'belaât'.

The microscopic examination of non-decomposed tissues disclosed a mycelium of continuous, torulose, intercellular hyphae, provided with occasional intracellular haustoria, and also subglobular cysts, with a thick, smooth membrane, scattered through the parenchyma cells. The mycelium sometimes forms small, creamy-white, velvety masses, consisting of mingled hyphae and cysts, in the basal tissues of diseased leaves, from which pure cultures of a *Phytophthora* with obpiriform conidia were obtained. These spores generally arose singly from the apex of an elongated stalk, which sometimes branched sympodially, the branches then forming other conidia. The fungus appears to be distinct from *P. palmivora*, the causal organism of bud rot of palms in India [*R.A.M.*, iv, p. 414; x, p. 361], with which the 'belaât' has certain features in common. The decay of the tissues initiated by the *Phytophthora* is completed by numerous saprophytes (Mucorales and yeasts) which soon produce fermentation and total liquefaction of the tissues.

McNamara (H. C.) & Hooton (D. R.). **Sclerotia-forming habits of the Cotton root-rot fungus in Texas black-land soils.**—*Journ. Agric. Res.*, xlvi, 9, pp. 807–819, 5 figs., 1933.

The results of a careful search [by a method which is described] during the summer and autumn of 1931 for sclerotia of *Phymatotrichum omnivorum* [*R.A.M.*, xii, p. 566] in the black clay soils of Texas, around the cotton plants that were the first to die from root rot, showed that these bodies did not occur in fields planted continuously to cotton, while they were numerous (usually in colonies or groups) in fields returned to cotton after three- or four-

year clean fallows and also in fields where cotton followed three years of non-susceptible crops. No sclerotia were found on the tap or large lateral roots of cotton, but only in the soil surrounding the small rootlets, and older sclerotia were also found at depths of 4 to 18 inches below the plough sole, most of them occurring at a depth of 4 to 12 inches. They also occurred (frequently in large numbers) near old tree roots or stumps that had been dead for many years. After the seat of infection in a primary centre had been located, continued digging failed to show other sources of infection.

These observations suggest that the sclerotia, which apparently are capable of long periods of quiescence, are connected primarily with the saprophytic stage of the organism, and serve as resting organs. They also indicated that where deep-seated infection exists, clean fallow or crop rotation as a method of control apparently needs supplementing by tillage operations that will reach the sclerotia.

McNamara (H.), Wester (R. E.), & Gunn (K. C.). **Persistent strands of the root-rot fungus in Texas.**—*Science*, N.S., lxxvii, 2004, pp. 510–511, 1933.

The examination of numerous primary centres of root rot (*Phymatotrichum omnivorum*) in continuous cotton plots in Wilson and Houston clay soils at Greenville, Texas, during 1931–2 showed that the fungus overwinters in the soil mainly as strands rather than in the sclerotial stage [see preceding abstract]. The strands were mostly found among the old, dead roots of plants killed by them the year before or earlier. New growth was readily made by some old strands found in 1932 on decayed cotton roots destroyed three years previously, as well as in the empty root channels of former plantings. Old strands found interlacing a colony of sclerotia in a plot that had been in clean fallow for five years were also viable.

The growth of the hyphae produced from the ends of old strands was characterized by radiating or parallel development of elongated cells which anastomose freely in the early stages. Later these structures were replaced by the more typical acicular hyphae with rectangular branches. The older strands consist of an outer cortical ring of thick-walled, irregular cells enclosing large, elongated, thin-walled, septate cells. In contrast to the more deeply seated infections of the far south-west, the strands at Greenville were found to be most abundant in the surface foot of soil, where they are relatively accessible to tillage operations or disinfectants.

Harding (D. B.) & Garr (C. C.). **Blastomycosis of bone.**—*Southern Med. Journ.*, xxvi, 4, pp. 315–320, 8 figs., 1933.

Clinical details are given of ten cases of blastomycosis of the bones (caused by one or more species of *Blastomyces*) [cf. *R.A.M.*, xii, p. 441], all in adults between 35 and 72 years old and half among farmers or farm labourers handling tobacco in Kentucky. The condition occurs either as a primary infection or secondary to lesions in other parts of the body, usually the skin or lungs. The symptoms resemble those of acute osteomyelitis at the onset, while

chronic osteomyelitis and tuberculosis are simulated in the chronic stages. The generalized infections are fatal.

NIÑO (F. L.) & PÉREZ (B.). **Blastomykose der Schleimhaut des Zahnfleisches und der Wangen.** [Blastomycosis of the mucous membrane of the gums and cheeks.]—*7ª Reunion Soc. Argentina Patol. Region. Norte*, i, pp. 413–423, 2 pl., 10 figs., Buenos Aires, Imprenta Univ., 1932. [Abs. in *Zentralbl. für Bakt.*, Ab. 1 (*Ref.*), cx, 9–10, p. 212, 1933.]

During the last two years the writer examined four cases of blastomycosis, of which the first was caused by *Cryptococcus psychrofilicus* [*R.A.M.*, xi, p. 644] and the others by *Mycoderma* [*Endomyces*] *dermatitidis* [ibid., xii, p. 441]. The case under discussion was one of blastomycetic granuloma (? also due to *E. dermatitidis*), which yielded to auto-vaccination.

VIVOLI (D.), AVELLANEDA (R.), & DE BARBIERI (ESTHER). **Glossitis ulcerosa, verursacht durch Monilia argentina (n. sp.).** [Glossitis ulcerosa caused by *Monilia argentina* (n. sp.).]—*7ª Reunion Soc. Argentina Patol. Region. Norte*, i, pp. 239–277, 37 figs., Buenos Aires, Imprenta Univ., 1932. [Abs. in *Zentralbl. für Bakt.*, Ab. 1 (*Ref.*), cx, 9–10, p. 214, 1933.]

A detailed account is given of the morphological and physiological characters of *Monilia argentina* n. sp., which was responsible for ulcerous glossitis in a 48-year-old male patient [cf. *R.A.M.*, xii, p. 441]. The fungus was isolated from abscesses on the tongue and lymph glands and inoculated into rats with positive results.

ROGERS (J. B.) & JELSMA (F.). **Torula meningo-encephalitis.**—*Journ. Amer. Med. Soc.*, c, 10, pp. 1030–1031, 1933.

Clinical details are given of a fatal case of meningo-encephalitis in a 47-year-old man caused by a species of *Torula* with budding cells 2 to 12 $\mu$ in diameter [cf. *R.A.M.*, xii, p. 94].

BONAR (L.) & DREYER (ALICE D.). **Studies on ringworm funguses with reference to public health problems.**—*Amer. Journ. Public Health*, xxii, 9, pp. 909–926, 4 figs., 1932.

*Trichophyton interdigitale* [*T. mentagrophytes*: *R.A.M.*, x, p. 243], a common agent of ringworm in American public baths, outdoor pavilions, and the like [ibid., xii, p. 569], developed readily on floor material covered with slime or algal growth. The complete destruction of the organism in skin scales by a 1 per cent. sodium hypochlorite solution [ibid., xii, p. 509] requires a period of one hour or more. In a series of thermal death point studies on spore suspensions of *T. mentagrophytes, Microsporon lanosum, Epidermophyton cruris* [*E. floccosum*], and *T. rosaceum* [ibid., xii, p. 173], the organisms were killed by ten minutes' exposure to 75° C. or below, *T. mentagrophytes* being the most resistant.

MUSKATBLIT (E.). **Ringworm of the toes in students and dispensary patients.**—*New York State Journ. of Med.*, xxxiii, 10, pp. 632–637, 1933.

An examination for ringworm of the toes was conducted on 100

dispensary patients and 112 medical students selected at random. Fungi were found microscopically or obtained in cultures in 31·6 per cent. of all the cases examined. Even when the fungi could not be detected microscopically, 5·2 per cent. yielded cultures. The commonest organism was *Epidermophyton interdigitale* [*R.A.M.*, xii, p. 444], followed by *E.* [*Trichophyton*] *rubrum* [ibid., xii, p. 509], *E. inguinale* [*E. floccosum*], and *T. gypseum*, while an important part was apparently also played by *Oidium rotundatum* Cast., *Monilia*, and *Cryptococcus* spp. A case of mixed infection by *E. interdigitale* and *Monilia* is described.

MUSKATBLIT (E.) & DIRECTOR (W.). **The trichophytin test: report of three hundred and fifty cases.**—*Arch. of Dermatol.*, xxvii, 5, pp. 739–744, 1933.

A method of preparation of a polyvalent fungous extract containing endo- and exo-products of *Epidermophyton interdigitale*, *Trichophyton violaceum*, and *Microsporon audouini* is described. The extract (0·1 c.c.) was injected intradermally into the forearms of 350 patients, 300 of whom were clinically mycotic, with positive results in 72·3 per cent. of the cases proved mycotic by laboratory examination. The cases in which the pathogen proved to be *E. interdigitale* reacted most readily to the test (22 out of 23), *E.* [*Trichophyton*] *rubrum* giving a positive reaction in 6 out of 9 cases, and *M. lanosum* in 7 out of 8. Six out of 12 cases of *Monilia* infection also gave a positive reaction.

It may be concluded from these results that the intradermal test with fungous extracts, while not absolutely specific, is of considerable value in the diagnosis of dermatomycoses, a high degree of cutaneous allergy being produced especially by *E. interdigitale.*

BROCHET (L.) & WILHELM. **Mycose cutanée observée à Teheran.** [Cutaneous mycosis observed at Teheran.]—*Fol. Med. Int. Orient.*, i, pp. 104–105, 1932. [Abs. in *Zentralbl. für Bakt.*, Ab. 1 (*Ref.*), cx, 9–10, p. 203, 1933.]

A description is given of the so-called 'carate' disease of the skin [*R.A.M.*, xii, p. 173], which occurs at Teheran in a similar form to that observed in Ceylon by Castellani and attributed by him to *Trichophyton ceylonense* (1908).

NIÑO (F. L.). **Mikrosporon-Trichophytie des behaarten Kopfes durch Ektothrix.** [*Microsporon* trichophytosis of the scalp caused by ectothrix.]—*7ª Reunion Soc. Argentina Patol. Region. Norte*, i, pp. 384–400, Buenos Aires, Imprenta Univ., 1932. [Abs. in *Zentralbl. für Bakt.*, Ab. 1 (*Ref.*), cx, 9–10, p. 202, 1933.]

Three juvenile patients were affected by a disorder of the scalp, characterized by brittleness and dullness of the hair, yellow, ulcerating crusts at the roots, and patches of baldness. Spores were observed in profusion on the diseased hair and on the ulcers; on Sabouraud's agar they developed into polymorphic hyphae, septate spindles, up to 50 by 15 $\mu$, being also present in older cultures. The fungus, which was inoculated into laboratory animals

with positive results, is considered to be a new species allied to *Microsporon felineum* and *M. flavescens*.

TALICE (R. V.) & MACKINNON (J. E.). **Drei Fälle von Pilzerkrankung des Ohres durch Aspergillus aus Montevideo.** [Three cases of fungous disease of the ear due to *Aspergillus* from Montevideo.]—*7ª Reunion Soc. Argentina Patol. Region. Norte*, i, pp. 278–284, Buenos Aires, Imprenta Univ., 1932. [Abs. in *Zentralbl. für Bakt.*, Ab. 1 (*Ref.*), cx, 9–10, p. 206, 1933.]

Three cases of otomycosis were investigated in Montevideo, from each of which a different species of *Aspergillus* was isolated, viz., a blackish variant of *A. niger*, a greenish-yellow variant of *A. flavus-oryzae*, and a new species, *A. montevidensis*, allied to *A. repens* and *A. amstelodami* [*R.A.M.*, x, p. 597].

AIMÉ (P.), CREUZÉ (P.), & KRESSER (H.). **Mycose pulmonaire à 'Penicillium crustaceum' avec signes cliniques et aspect radiologique d'abcès du poumon.** [Pulmonary mycosis due to *Penicillium crustaceum* with clinical symptoms and radiological aspect of an abscess of the lung.]—*La Presse Méd.*, xli, 37, pp. 761–763, 5 figs., 1933.

Full clinical and radiological particulars are given of a severe case of pulmonary mycosis in a female patient in France caused by *Penicillium crustaceum*. The fungus formed on liquid media a thick, dry, bluish-green mycelium (whitish under the microscope) of a felty consistency, producing chains of spherical or elliptical, whitish conidia. A cure was effected by means of potassium iodide. This is believed to be only the third record of the involvement of *P. crustaceum* in the causation of lung trouble [cf. *R.A.M.*, vi, p. 483; xii, p. 511].

TRANZSCHEL (V.), GUTNER (L.), & KHOKHRYAKOFF (M.). **Список грибов, встречающихся на новых культурных прядильных растениях.** [List of fungi occurring on new cultivated textile plants.]—*Инст. Нового Лубяного Сырья ВАСХНИЛ.* [*Inst. New Bast Raw Material VASKhNIL*], Leningrad, No. 1, pp. 127–140, 1933.

This is a list, arranged by the hosts, of the parasitic fungi that have been described on the following fibre-producing plants which are stated to be recent introductions into cultivation in Russia, namely, *Apocynum* sp., *A. cannabinum*, *A. androsaemifolium*; *Boehmeria nivea*, *B. candidissima*, *B. cylindrica*, *B. japonica*, *B. tenacissima*; *Hibiscus cannabinus*; *Abutilon avicennae*, *A. hybridum*, *A. sordidum*, *A. theophrastii*; *Dipsacus fullonum*, *D. pilosus*, *D. sylvestris*; *Cannabis sativa*; *Asclepias cornuti*, *A. curassavica*, *A. fruticosa*, *A. incarnata*, *A. pneumonanthi*, *A. variegata*, *A. verticillata*, and an undetermined species of this genus. The following species of fungi included in the list are described by Khokhryakoff [transcribed by the author in the diagnoses as Chochrjakow] as new to science. *Septoria apocyni*, which forms

on the stems of *A. venetum* whitish, oblong or oval, rarely discrete spots; the pycnidia are brown, 150 to 200 $\mu$ in diameter, and contain four-celled stylospores, measuring 25 to 46 by 3 to 4 $\mu$. In association together and with other fungi on the leaves of *B. nivea* were found the three new species *Coniothyrium boehmeriae* with pycnidia up to 90 $\mu$ in diameter and fuliginous, continuous stylospores measuring 6 to 7·5 by 3 $\mu$; *Hendersonia boehmeriae* with pycnidia up to 77 $\mu$ in diameter and four-celled, fuliginous stylospores measuring 13 to 15 by 4 to 5 $\mu$; and *Microdiplodia boehmeriae* with pycnidia up to 80 $\mu$ in diameter and two-celled, fuliginous pycnospores measuring 7 to 9 by 3 to 3·5 $\mu$. *Ascochyta hibisci-cannabini* n. sp. formed on the leaves of *H. cannabinus* amphigenous, greyish-brown, rounded, sharply delimited spots, up to 10 mm. in diameter; the pycnidia are epiphyllous, light brown, up to 180 $\mu$ in diameter, and the stylospores hyaline, cylindrical, rounded at both ends, first continuous, later two-celled, and 5 to 10 by 2·5 to 4·5 $\mu$. *Coniothyrium abutilonis* n. sp. forms on the leaves of *A. avicennae* greyish-brown or ochre-coloured spots up to 5 mm. in diameter, with an indistinct dark margin; the pycnidia are epiphyllous, dark brown, more or less aggregated or dispersed, and 50 to 150 $\mu$ in diameter, containing elliptical, fuliginous stylospores, measuring 6 to 7 by 3 to 3·5 $\mu$. *Leptosphaeria abutilonis* forms on the leaves of the same host small, greyish-brown spots with a dark margin, and occurs in association with *Ascochyta abutilonis*; its perithecia are dark brown, occasionally aggregated, and 120 to 1,250 $\mu$ in diameter, with asci 55 to 62 by 9 to 12 $\mu$, and spindle-shaped, light yellow spores, with 5 septa, acute at both ends, straight or bent, 24 to 30 by 4·5 $\mu$. *M. abutilonis* n. sp. occurred also on the leaves of this host on which it forms whitish spots with a thin dark margin; the pycnidia are 75 to 150 $\mu$ in diameter, and have thin, translucent walls, and the stylospores are two-celled, slightly constricted, fuliginous (brown in mass), and measure 6 to 8 by 3 to 3·5 $\mu$. A fuller description of these fungi is reserved for a future publication.

ALLEN (RUTH F.). **The spermatia of Flax rust, Melampsora lini.** —*Phytopath.*, xxiii, 5, p. 487, 1933.

This is an expanded note of the writer's studies on heterothallism in flax rust (*Melampsora lini*), an abstract of which has already been noticed [*R.A.M.*, xii, p. 362]. In infections fixed shortly after smearing spermatial exudate on the leaf surface, the spermatium has been observed to flatten down on to the epidermal wall, to which it becomes attached by a secretion, and it then pushes out a fine beak that penetrates the wall diagonally, in all probability partly by mechanical force and partly by enzymatic action. The spermatium enters and traverses the epidermal cell, possibly being conveyed passively by cytoplasmic streaming. At this stage many spermatia die, perhaps as a result of defensive action on the part of the host, but a few apparently survive. At the inner wall the process described above is repeated, but the beak of the spermatium after penetrating the wall develops into a hypha in the intercellular spaces.

Cook (H. T.) & Walker (H. G.). **Rose diseases and insects and their control.**—*Virginia Truck Exper. Stat. Bull.* 79, pp. 1053–1066, 6 figs., 1932. [Received July, 1933.]

Popular notes are given on the following diseases affecting roses in the United States, with directions for their control: powdery mildew (*Sphaerotheca pannosa* var. *rosae*), black spot (*Diplocarpon rosae*), anthracnose (*Sphaceloma rosarum*) [*R.A.M.*, xii, p. 447], rust (*Phragmidium* spp.), brown canker (*Diaporthe umbrina*) [ibid., xii, p. 291], brand canker (*Coniothyrium wernsdorffiae*), stem canker (*C. fuckelii*) [*Leptosphaeria coniothyrium*: ibid., xi, p. 767], cane blight (*Botryosphaera ribis* var. *chromogena*) [ibid., x, p. 792], crown gall (*Bacterium tumefaciens*), and blossom blight (*Botrytis* sp.).

**Die Welkekrankheit der Astern.** [Wilt disease of Asters.]—*Blumen- und Pflanzenbau*, xlviii, 5, p. 72, 1933.

Among the most serious diseases of asters in Germany are the two forms of wilt, one caused by *Fusarium* spp. (including *F. dianthi, F. roseum* [*Gibberella saubinetii*], and *F. culmorum*), and the other ('yellow wilt') by *Verticillium cinerescens* [*R.A.M.*, ix, pp. 6, 37; xii, p. 448]. The former is the more prevalent of the two. For the first time seeds of varieties reputed to be completely resistant to wilt have been placed on the market during the current season by the firm of A. Hoch, Berlin-Neukölln.

Hall (A. D.). **The transmission of Tulip breaking.**—*Gard. Chron.*, xciii, 2420, pp. 330–331, 1 fig., 1933.

In 1932 the tulip breaking [*R.A.M.*, xii, p. 292] experiments carried out by McKenny Hughes at the John Innes Horticultural Institution were mainly concerned with the aphids transmitting infection. Insect-proof greenhouse compartments were planted with blocks of four varieties, viz, Prince of Austria, Clara Butt, Bartigon, and Zulu, 100 in each block, the same number being planted elsewhere as controls. When the buds were beginning to open, several pots of growing broken tulips, on the leaves of which a particular aphid colony had been established, were introduced into each compartment.

As in previous tests, *Myzus persicae* proved to be the most active vector, conveying the floral symptoms of breaking to 14 out of 50 Bartigons while a number of other plants were so weakened that they failed to flower, and some were killed outright. *Macrosiphum gei* caused definite breaks in a small number of plants and *Anuraphis tulipae* was implicated as a carrier of infection in store, where it passes from broken to healthy bulbs.

Further experiments showed that tulips do not transmit the virus from the leaves to the newly forming bulbs, as they approach maturity, infective aphids applied to a batch of Bartigon just when the petals were beginning to drop, and again a week later to a second batch, failing to transmit infection to the new bulbs.

Several of the bulbs infected by *Myzus persicae* from 'full breaks' gave 'self breaks', the virus responsible for the latter being evidently independent of that causing the ordinary full

breaking. The Zulu bulbs infected from full breaks showed 'clotted' breaks, which also developed in another test with the Isis variety. However, when aphids were fed on clotted breaks and placed on Bartigon they induced the ordinary full breaks. It is tentatively concluded that clotting is the form taken by breaking in tulips such as Zulu or Isis, with an intense crimson or purple colour and a smooth, shiny texture, on which full breaking has not been observed.

KOLBE (R. W.). **Allgemeines über die Anzucht der Orchideen aus Samen.** [General observations on the raising of Orchids from seed.]—*Blumen- und Pflanzenbau*, xlviii, 5, pp. 64–65, 3 figs., 1933.

An account is given of the symbiotic relationship between orchids and root fungi [*Rhizoctonia* spp.], and of the adaptation of Clement's methods of raising the plants [*R.A.M.*, v, p. 758] on a commercial scale by a German firm 'Orchidflora' (H. Kruyff, Neubabelsberg).

VAN BEYMA THOE KINGMA (F. H.). **Beschreibung einiger neuer Pilzarten aus dem Centraalbureau voor Schimmelcultures—Baarn (Holland.)** [Description of some new species of fungi from the Centraalbureau voor Schimmelcultures—Baarn (Holland).]—*Zentralbl. für Bakt.*, Ab. 2, lxxxviii, 5–7, pp. 132–141, 9 figs., 1933.

Morphological and cultural details are given of seven new species of fungi identified by the writer at the 'Centraalbureau voor Schimmelcultures'. *Sclerotium cacticola* n. sp., isolated from the roots of an *Opuntia* in a living-room, is characterized by spherical to potato-shaped, greyish-white to brownish sclerotia, 1 mm. in diameter (up to 2 mm. in pure cultures on beer wort agar), which assume a pale, coffee colour after about nine months. The mycelium on the same medium is white (later greyish), fibrous, and radiating in all directions; at the periphery of the colony the hyphae project up to 3 mm. above the surface of the agar and form loose, white, paintbrush-like heads. The growth of the infected plant was completely arrested.

HÖHNEL (F. v.). **Über Volutella buxi (DC.) Berk.** [Note on *Volutella buxi* (DC.) Berk.]—*Mitt. Bot. Inst. Tech. Hochschule Wien*, ix, 2, pp. 44–46, 1932. [Received July, 1933.]

In this brief posthumous note the author states that *Volutella buxi* [a parasite of box (*Buxus sempervirens*): *R.A.M.*, x, p. 34] does not really belong to this genus, and creates for it a new genus *Chaetodochium* [a German diagnosis of which is given] with *C. buxi* (DC.) Höhn. as the type species. An examination of the type specimen of *Chaetostroma buxi* Cda var. *rusci* Desmazières showed that this fungus also should be referred to the new genus under the name *C. rusci* (Desm.) Höhn.; it appears to be distinct from *Volutella rusci* Sacc.

*Chaetodochium* has parenchymatous, hemispherical, hyaline or light-coloured sporodochia, covering the stomata of the host and

arising from a hyaline, parenchymatous fungal tissue which fills the stomatal chamber. Hyaline setae develop at the margin of the sporodochium, the surface of the latter being covered with simple conidiophores on which hyaline, continuous, elongated to spindle-shaped conidia are borne.

SANFORD (G. B.). **A root rot of Sweet Clover and related crops caused by Plenodomus meliloti Dearness and Sanford.**—*Canadian Journ. of Res.*, viii, 4, pp. 337–348, 2 pl., 2 graphs, 1933.

Sweet clover (*Melilotus alba*), lucerne, and common clover (*Trifolium pratense*) in Alberta and Saskatchewan are subject to a disease caused by *Plenodomus meliloti* [*R.A.M.*, xi, p. 303] for which the name 'brown root rot' is proposed. The first symptom is the formation of brown, slightly sunken, necrotic lesions on the tap or lateral roots and rootlets, infection from which spreads rapidly throughout the tissues, especially the pith, as soon as the surface soil thaws after winter. The lesions frequently involve the lower two-thirds or three-quarters of the root system, but new crown roots and shoots are often produced, so that partial recovery may occur. *P. meliloti* appears to be indigenous in the cultivated black soils of the prairie areas under observation.

The uni- or multilocular pycnidia [ibid., x, p. 110] are formed in dense clusters both on the host and in culture. The pycnospores are usually produced when the pycnidium is about 50 days old and are liberated through one or several ostioles 30 to 50 days later. The young hyphae are hyaline and closely septate, turning brown and thick-walled with age; they measure 2 to 5 $\mu$ in width. The temperature range for growth and pycnidial production in *P. meliloti* is from 0° to 27° C., with an optimum between 15° and 17°. Severe lesions are formed on inoculation of overwintered plants at 2° to 3°, 9°, and 16°. The optimum hydrogen-ion concentration for the growth of the fungus in potato dextrose decoction is $P_H$ 6·2 with a range extending from 3·2 to 8·2. These data explain the prevalence of brown root rot in the typically black or wooded soils with a reaction of $P_H$ 6 to 7, and its absence from the alkaline brown soils of the prairie belt.

It was shown by experiments that unfrozen roots of sweet clover, up to four months old, are immune from *P. meliloti* at soil temperatures from 12° to 27°, and also that first-year roots of sweet clover and lucerne are not susceptible to the fungus before winter dormancy. During or just after winter, however, all inoculations on both hosts at the low soil temperature then prevalent gave positive results. In the case of clover the observations were complicated by the occurrence of severe winter injury, but typical brown root rot lesions were produced by *P. meliloti* on the relatively winter hardy Late Swedish Red and Alta-swede varieties. So far sweet clover appears to be the most susceptible of the three hosts, the following varieties being affected: Arctic, Common White, Maccor, Zouave, Grundy. The Grimm, Baltic, Cherno, and Cossack lucernes are susceptible as well as nine clover varieties, including the above-mentioned and Mammoth. Pycnidia have

also been found during May on dead roots of *Axyris amaranthoides*, *Amaranthus retroflexus*, and oats.

A culture of *P. meliloti* on sterilized soil was found to be still viable after 20 months in the laboratory, when the moisture content of the soil was only 4·4 per cent. of its water-holding capacity. Probably the wind is the most effective agent in the dissemination of the brown root rot organism, the sole means of combating which would appear to be either by crop rotation or by the use of resistant varieties.

PELTIER (G. L.). **The relative susceptibility of Alfalfas to wilt.**—*Nebraska Agric. Exper. Stat. Res. Bull.* 66, 16 pp., 1933.

The results of continued tests of strains and varieties of lucerne of various origin for resistance to wilt (*Aplanobacter insidiosum*) [*R.A.M.*, x, p. 525, xii, p. 221; and above, p. 615] confirmed the resistance of the Turkestan strains originating from the districts of Khiva, Chimbai, Alma-ata, Tashkent, Samarkand, and Chardzhui both to the disease and to cold, while those from the districts of Bukhara, Askhabad, and Ferghana were found not to be sufficiently hardy for Nebraska conditions, the same applying to several strains from Persia and one from India. Hardistan and a recently described new variety Kaw, both of which are probably strains of Turkestan lucerne, appear to be promising because of their resistance to wilt and cold. All the other varieties and strains tested, irrespective of origin, were found to be susceptible to the disease.

BRADFORD (F. C.) & JOLEY (L.). **Infectious variegation in the Apple.**—*Journ. Agric. Res.*, xlvi, 10, pp. 901–908, 1 fig., 1933.

A brief account is given of a variegation, consisting of small yellow or cream-white spots of irregular shape, which was first observed in the spring of 1928 at the Michigan Agricultural Experiment Station on the leaves of single- or double-grafted Red Canada (Steele Red) apple trees. The appearance was exactly similar to that reported and figured in 1916 by Morse from Maine (*Maine Agric. Exper. Stat. Bull.* 252, 1916) and was probably also the same as in the apple mosaic found in 1923 in New York [*R.A.M.*, iv, p. 15]. Further work, details of which are given, showed that the condition is transmissible by grafting to the intermediate scion and to the rootstock, and variegated Red Canada scions set in mature apple trees produced a variegation which spread throughout the latter to the tips of the ungrafted branches. While none of the apple varieties so far tested was wholly immune, differences were noticed if not in their relative susceptibility, at least in the manifestation of the symptoms, the latter being more pronounced on the seedling rootstocks than in the varieties grafted on them. Buds taken from a tree showing no variegation produced it in seedling stocks. The effect of the condition on the tree has not yet been established.

Reference is made to several early reports of the transmission by grafting of variegation in several woody plants in Europe, especially to one recorded by Vibert in France in 1863 in which

apple trees on which varieties with variegated foliage had been shield-budded produced branches with variegated leaves.

SYLWESTER (E. P.) & COUNTRYMAN (MARY C.). **A comparative histological study of crowngall and wound callus on Apple.** —*Amer. Journ. of Botany*, xx, 5, pp. 329–340, 2 pl., 7 figs., 1933.

The histological development and microchemical reactions of the tissues of crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) and non-pathogenic callus knots on apple grafts [*R.A.M.*, xi, pp. 378, 461, *et passim*] were compared at the Iowa State College, the distribution of the bacteria in the former condition also being studied.

The following features were found to be common to both types of overgrowth. The latter consists of proliferated host tissue, derived from tissues external to the xylem cylinder. Within the parenchymatous overgrowth internal differentiation takes place in the form of isolated spheres, whorls, cylinders, or sheets of meristematic cells. Those 'meristematic islands' are characterized by the regular, cambium-like division of the peripheral cells, which produce stratified derivatives on the inside and parenchyma on the outside. The meristematic islands undergo centrifugal differentiation into lignified, contorted xylem elements. In a given island meristematic activity terminates after about three weeks, but new islands arise progressively in the parenchymatous margin of the overgrowth. The enlargement of the latter is effected partly by superficial proliferation and partly by meristematic activity in the internal islands. The microchemical reactions of callus and crown gall are practically identical for cellulose, pectin, lignin, and gums. No true vascular connexion was found between the overgrowth and the tree, the apparent continuity of the woody core of the knot with the main stem resulting from the gradual coalescence and differentiation of the numerous meristematic islands.

The following points of difference were observed between crown gall and callus knots. Near the surface of the former there is usually a zone of dark, polygonal, closely packed cells readily distinguishable from the surrounding parenchyma, whereas the periderm of a graft callus generally resembles that of the normal stem. The tannin test was positive in crown gall tissue and negative in that of the callus knots. Sclerenchyma cells appear to be present only in crown gall. *Bact. tumefaciens* was found in profusion on the surface of the apple galls, in the schizogenous cavities, and in the partially disorganized cells near the surface.

GLOYER (W. O.). **Evaluation of applications of lime-sulphur for the control of Apple scab.**—*New York* (*Geneva*) *Agric. Exper. Stat. Bull.* 624, 39 pp., 6 graphs, 1 diag., 1933.

An account is given of the results of three years' tests (from 1930 to 1932) at the New York (Geneva) Agricultural Experiment Station of the relative efficacy of various schedules of spraying with lime-sulphur in the control of apple scab (*Venturia inaequalis*) [*R.A.M.*, xii, p. 451]. A standard method of experimentation

(termed the 'Geneva system') was devised for the evaluation of the treatments which, it is suggested, may be equally useful in all similar tests. As applied to lime-sulphur, it consisted in giving different lots of trees in a Ben Davis orchard from one to five applications of the fungicide as recommended in the usual spraying schedule, the various treatments being arranged in an increasing and decreasing gradation of applications, starting from the first (delayed dormant) spray to the fifth (second cover) in the ascending sequence, and omitting the first, first and second, first, second, and third, &c., spray in each step of the descending sequence, until only the fifth and last spray was applied.

The results of the experiments indicated that lime-sulphur both gives protection against, and has an eradicative action on, the scab fungus, the latter being manifested by the early as well as by the late sprays. Under normal temperature conditions it was found that the apple-leaf cuticle protects the inner tissue from lime-sulphur injury, but when it is ruptured by the scab mycelium, the lime-sulphur penetrates the deeper tissue and kills it within the limited area including the mycelium, a process which has often been considered to be an evil effect of the spray, whereas in reality it indicates its beneficial effect in destroying the parasite. Scab spots may also be eradicated on the fruit during the first cover spray, leaving, however, a russety circular spot of more or less corky tissue; on Ben Davis their formation was only found in tree lots which received the first and second cover sprays.

The investigation showed that the efficiency of lime-sulphur is exerted at three vulnerable stages in the development of scab, namely, (*a*) it inhibits the germination of the spores if applied prior to a favourable rain period, thus protecting the leaves from infection; (*b*) initial stages of infection may be partly eradicated by an application as early as possible after a rainy period; and (*c*) its eradicative function is fully displayed when it is applied at the end of the 12-days' incubation period, when the mycelium has ruptured the cuticle: this function, however, cannot be exerted to its greatest capacity when there are overlapping infection periods. The efficacy of the treatment depends, therefore, on the ability of the grower to synchronize the first application with these vulnerable stages. In the experiments the outstanding feature, as shown by surveys in July and at harvest time, was the efficacy of the delayed dormant (first) and calyx (third) applications (which gave 16·79 and 20·73 per cent. scabbed fruit at harvest time, respectively), as contrasted with the pre-blossom (second) spray, which showed 47·41 per cent. scab on the harvested apples, and which also failed to control the fungus on the leaves. It was also found that the relative efficacy of an application may be greatly altered during the interval between July and the harvest (end of October); this is attributed to the time factor, and is related to the amount of scab remaining on the fruit after the application of a spray. From this standpoint it is suggested that the most reliable information about the date of an infection is to be obtained from the record of the largest scab spot present on the fruit, rather than from the usual classification of scab according to the total scabbed area.

MOORE (M. H.). **Spraying experiments on the control of Pear scab at East Malling.**—*Journ. Min. Agric.*, xl, 2, pp. 111–119, 2 pl., 1933.

An account is given of spraying experiments in 1931 and 1932 at the East Malling Research Station on the control of pear scab [*Venturia pirina*: *R.A.M.*, xii, p. 453] on Fertility pear trees worked on four different stocks of quince. In both years, in which scab was very prevalent, lime-sulphur (1 in 30 pre-blossom and 1 in 60 post-blossom) and burnt lime Bordeaux mixture (8–8–100 both pre- and post-blossom) gave practically equal control; the latter gave a higher percentage of clean fruit, while with the former the spots were smaller though there was more late infection, doubtless owing to the necessity of considerably reducing the strength of the spray in the post-blossom application to avoid injury to the trees. There was some evidence that the pre-blossom application of lime-sulphur may give better control of early infection than Bordeaux mixture, and this method might usefully be tried in orchards where red spider [*Tetranychus telarius*] is prevalent.

Hydrated lime Bordeaux mixture (8–12–100, pre- and post-blossom) was less effective than the burnt lime mixture in 1931 and more effective in 1932. The fact that it is easier to prepare than the latter, and also that in 1931 it caused the lesser injury of the two, indicates that it should be preferred in general practice. A good basic spraying schedule is considered to be three applications of the hydrated lime mixture at 'white bud', 'petal fall', and three weeks later, to be supplemented, if necessary, according to seasonal conditions. The experiments also indicated that the nature of the rootstock affects the relative resistance to *V. pirina* of the trees worked on it [cf. ibid., xii, p. 298], and their reaction to spray treatment.

Colloidal sulphur spray (8 lb. in 100 gall. water pre- and 4 in 100 post-blossom) gave unsatisfactory results in both years.

FIORE (MARIA). **Ricerche sulla causa di una gommosi diffusasi in alcuni frutteti di Torre del Greco.** [Researches on the cause of a widespread gummosis in some orchards at Torre del Greco.]—*Bull. Orto Bot. R. Univ. Napoli*, x, pp. 5–20, 5 col. pl. [? 1932. Received August, 1933.]

A brief account is given of a disease of fruit trees (apricots, peaches, oranges, &c.) which, according to the statements of local growers, is spreading at an ever increasing rate in the orchards of Torre del Greco, and which they ascribe to the noxious vapours emitted by Vesuvius or to the very hot rains which occasionally fall in that region. Field observations showed that the trouble usually starts in the youngest twigs, the first symptom being a more or less copious exudation of gum, followed by a die-back of the limbs, and terminating in the death of the whole tree in one or two years at the most. New trees planted in the soil from which a dead one was removed usually perish in the same way and this, together with the fact that the roots of diseased trees always show a characteristic orange-pink discoloration, led the author to suspect a parasitic origin of the trouble. This is

considered to be confirmed by the constant presence in the diseased tissues of four fungi, namely, a mycelium of the *Alternaria* type which in pure culture produced conidia typical of this genus, a species of *Fusarium*, pycnidia of the *Phoma* type, and a species of *Ascospora* with membranaceous or carbonaceous, minute, globose or sub-conical, dark brown (almost black) perithecia, from 130 to 180 $\mu$ in diameter, containing globose-ovate asci, 22 to 24 by 24 $\mu$, with eight ellipsoidal, continuous, at first hyaline and later slightly pinkish or yellowish ascospores, measuring 8 to 10 by 4 to 6 $\mu$. This fungus is considered to be new to science and is named *A. longi*, a Latin diagnosis being appended.

It is thought that all the fungi mentioned are probably stages in a single life-history.

TRIQUART (J.). **Bekämpfung der Monilia auf Sauerkirschen.** [Control of *Monilia* on sour Cherries.]—*Obst- und Gemüsebau*, lxxix, 5, pp. 73–74, 2 figs., 1933.

Morello cherries are stated to have suffered severe damage in the Palatinate, Rhenish Hesse, and the Frankfurt district of Germany during recent years from infection by *Monilia* [*Sclerotinia cinerea*: *R.A.M.*, x, p. 678]. The Ludwigs Frühe [Early] variety, reputed resistant to the fungus, has the drawback of small fruits and insipid flavour. The writer's extensive observations in Germany, Czecho-Slovakia and northern Hungary indicate that infection by *S. cinerea* is most prevalent in sheltered localities on unsuitable soil [ibid., iii, p. 457]. Strictly sanitary cultivation and the immediate excision of diseased material are essential to control.

**Sprøjtning af Stikkelsbærbuske samt Ribs- og Solbærbuske.** [The spraying of Gooseberry and of red, white, and black Currant bushes.]—*Statens Forsøgsvirksomhed i Plantekultur, Medd.* 146, 4 pp., 1 fig., 1933.

The following is recommended as a suitable summer spraying schedule for the control of gooseberry mildew (*Sphaerotheca mors-uvae*), gooseberry rust (*Puccinia pringsheimiana*) [*R.A.M.*, xi, p. 262], and *Gloeosporium* [*Pseudopeziza*] *ribis* [ibid., viii, p. 753] and *Septoria ribis* [*Mycosphaerella grossulariae*] on gooseberries and currants in Denmark. (1) Shortly after the bushes come into leaf and again two to three weeks later: alkaline Burgundy mixture; (2) immediately after flowering: the same; (3) directly after picking the fruit: Bordeaux mixture 1 : 1 : 100 (primarily against *G. ribis*); and (4) whenever infection by *S. mors-uvae* is noticed: formalin 0·5 : 100. Directions are also given for combating the insect pests of these fruits.

SLATE (G. L.) & RANKIN (W. H.). **Raspberry growing in New York State: cultural practises and disease control.**—*New York (Geneva) Agric. Exper. Stat. Bull.* 625, 62 pp., 10 figs., 1933.

This bulletin summarizes in popular language all the work so far done in New York regarding the various cultural practices tending to improve the quality and yield of raspberries, and also the control of the chief diseases affecting the crop [brief descrip-

tions of which are given under their common names]. Considerable space is given to a popular discussion of the virus diseases of raspberries, mostly reproducing information already noticed from other sources [*R.A.M.*, x, p. 530; xi, p. 381].

BONGINI (VIRGINIA). **Una malattia del Nespolo giapponese (Eriobotrya japonica).** [A disease of the Loquat (*Eriobotrya japonica*).]—*La Difesa delle Piante*, x, 1, pp. 4–8, 1933.

In the wet, cool summer of 1932, 7- to 8-year-old loquats (*Eriobotrya japonica*) growing in heavy soil about 500 m. above sea level near Turin, some of which had four years previously been subject to an insect attack in the wood, wilted from the base upwards. The bark of the trunk and main branches turned a rusty red and peeled off, while young, growing limbs developed cankers somewhat resembling those due to *Bacillus amylovorus.* The course of the disease was, however, quite unlike that of fireblight. The wood was brown near the top and a rusty red near the base. The 4- to 5-year-old branches developed longitudinal and transverse cracks in the bark, dividing it into areas of dead tissue, under which was a layer resembling wound callus. The bark was easily detachable and the outer cells of the underlying tissue were suberized, those further in being sclerenchymatous or collenchymatous. In this tissue a copious mycelium was found, which was present also in the detached bark, but not in the cambium or wood. The 1- and 2-year-old branches developed a dark, sunken, elliptical lesion which split longitudinally, revealing dried cracks in the phloem, through which the darkened woody cylinder appeared. Occasionally, the lesion and crack were transverse, in which case the canker quickly girdled the branch. On the affected branches the leaves turned a chlorotic red and dropped, but new shoots were put out in the autumn.

The mycelium in the cortex consisted of intercellular, hyaline, branched, septate hyphae, often in thick wefts, with stromatic masses on the outside. Aggregated, globose, somewhat compressed, glabrous, ostiolate, dark-walled pycnidia developed in the stromatic layers in the cracks of the phloem and on the inner surface of the loosened bark. They measured 87 to 100 $\mu$ in diameter and contained rod-shaped, hyaline, non-guttulate stylospores, borne on unbranched stalks and measuring 2·5 by 1 to 1·5 $\mu$, which were extruded in long tendrils. The fungus was not observed on the leaves, though both these and the leaf scars on the branches showed the presence of *Hendersonia eriobotryae.*

The organism, which is regarded as a weak parasite attacking only predisposed trees and, probably, not directly responsible for the cankers, is named *Phoma eriobotryae* n. sp. A Latin diagnosis is given, and there is a bibliography of 12 titles.

TAI (F. L.) & CHEN (C. C.). **A dry rot of Pomegranate fruit caused by Zythia versoniana Sacc.**—*Lingnan Sci. Journ.*, xii (*Supplement*), p. 151, 1933.

Heavy losses are stated to be caused annually in the Nanking district of China by a dry rot of pomegranate [*Punica granatum*] fruit due to *Zythia versoniana*, first reported from Northern Italy.

In 1931 the disease caused losses of over 30 per cent. of the crop. The pathogenicity of the organism was demonstrated by inoculation and reisolation experiments. Overwintering tests were initiated in December, 1931, when one set of diseased fruits was hung outside the window and another buried in the soil. In April and May, 1932, the pycnospores of the former set germinated to the extent of 9·3 to 10·5 per cent., while no germination occurred in the latter. The perfect stage previously reported, *Nectriella versoniana* [*R.A.M.*, x, p. 774], was frequently found associated with the pycnidial form, but the genetic connexion between the two stages has not yet been definitely determined.

CORNELL (F. D.). **Recent developments in stationary spray systems in West Virginia.**—*Agric. Engin.*, xiv, 3, pp. 79–80, 1 fig., 1933.

In a further survey of stationary spray systems in West Virginia [*R.A.M.*, viii, p. 658] the author found that the general practice now is to use considerably higher pressures (600 or even 700 lb.) than formerly. Instead of spray guns, three- and four-nozzle rods are now in common use. Another change consists in the use of $\frac{1}{2}$ or $\frac{3}{4}$ in. hose in place of the earlier $\frac{3}{8}$ in., the length of hose being simultaneously reduced from 250 to 150 or 125 ft. by the installation of more laterals. All the new lateral pipes are of $\frac{3}{4}$ to 1 in. capacity.

An attempt was made to compare the costs and efficacy of the stationary and portable spraying systems, a few of the purely provisional data on which from 5 stationary and 10 portable systems are given here while the rest are available on request at the West Virginia Agricultural Experiment Station. The quantities of spray materials used during the three-year period 1930 to 1932 ranged from 3·4 to 8·4 galls. per tree for the stationary and from 2·3 to 11·7 galls (or 7·2 discounting one case of excessive consumption) for the portable equipment. The quantities of materials applied per tree per season for all sprays ranged from 19·8 to 47·8 galls. for the stationary and 12·5 to 43·4 for the portable (nine orchards). Per man-hour the amounts of spray fluctuated between 45 and 166 galls. for the stationary plants, and between 25 and 109 for the portable outfits. The total cost of spraying by the stationary method ranged from 18 to 60 cents per tree per season, the corresponding figures for the portable system being 19 cents to $1·2 (the latter figure is exceptionally high owing to the use of excessive quantities by one grower).

GOETZ (O.) & WINKELMANN (A.). **Der Schwefelvernebelungsapparat 'Sulfurator'.** [The sulphur vaporization apparatus 'Sulfurator'.]—*Obst- und Gemüsebau*, lxxix, 5, pp. 72–73, 4 figs., 1933.

Highly satisfactory results are reported of the writers' experiments in the control of rose, hydrangea, and chrysanthemum mildews [*Sphaerotheca pannosa*, *Microsphaera polonica*: *R.A.M.*, xii, p. 550, and *Oidium chrysanthemi*] by the large, medium, and small types of sulphur vaporization apparatus [ibid., xii, p. 175].

Riehm (E.). **Beizgeräte.** [Seed disinfection apparatus.]—*Biol. Reichsanst. für Land- und Forstwirtsch. Flugbl.* 82, 4 pp., 4 figs., 1933.

This is a descriptive list of German cereal seed-grain disinfecting apparatus, under the headings of dusting, liquid, semi-liquid, and hot water treatments. In each case the address of the constructor of the apparatus, as well as the working capacity and the price of the latter, are given, and a few of the types are illustrated.

Wilson (J. D.) & Tilford (P. E.). **The use of formaldehyde dust in growing seedlings.**—*Ohio Agric. Exper. Stat. Bull.* 520, 40 pp., 5 figs., 1933.

This bulletin gives details of experiments to determine the factors influencing the efficacy of the formaldehyde dust treatment developed by Sayre & Thomas [*R.A.M.*, vii, p. 159] and subsequently used for the control of damping-off of tomato seedlings (*Pythium ultimum* and *Rhizoctonia* [*Corticium*] *solani*) [ibid., xi, p. 409]. The dust was tested against various organisms causing seed-bed diseases of vegetable and flower seedlings, chiefly belonging to the genera *Pythium*, *Rhizoctonia*, and *Fusarium*, listed in the order of their destructiveness. The results showed that mass treatment of the soil with the standard dust (which carries 6 per cent. of formaldehyde) at the rate of 1½ oz. per sq. ft. markedly reduced damping-off of the seedlings in most cases. While most of the seedlings emerged about 24 hours later than in the controls, at the moment of transplantation those growing in treated soil were larger and had more extensive root systems than the controls of the same age, the beneficial effect of the treatment being particularly marked in a number of ornamentals and in beet, cucumber, pea, spinach, and tomato among the vegetables. In a few instances, however, the treatment was injurious to the seedlings, and seeds of campanula, petunia, *Anchusa* [*officinalis*], lettuce, and most of the crucifers, should not be planted until about 24 hours after the soil has been treated. The same also applies to all seed known to be of low germinative vigour. The dust should be worked into the topmost 3 inches of soil, or when used in pots or other containers should be thoroughly mixed with the soil at the rate of 8 to 12 oz. per bushel, depending on the type of soil. With the more formaldehyde-resistant plants good control of seedling diseases was also obtained by introducing the dust in rows together with the seeds at a rate not over 1 oz. of the 6 per cent. dust to each 30 ft. of the row ; if dust carrying 4·5 per cent. formaldehyde (which is usually more desirable in row applications, since it flows more freely from the drill and can be more evenly applied) is used, the rate of application may be increased to 1 oz. per 22½ ft. (1 oz. per 30 ft. for plants sensitive to formaldehyde).

Injury to germinating seeds from the treatment was found to occur chiefly at medium soil moisture contents, and was largely eliminated by thoroughly drenching the soil with water immediately after treatment and planting. It was most severe in coarse soils, such as sand, and least severe in those with a high content in organic matter. Drenching the soil with a dilute solution of formaldehyde, while effective, was found to be much more likely

to injure or stunt the seedlings than the dust, and it may also be objectionable because of the physical effect it has on certain soils.

Seedlings should not be transplanted into soil treated with the dust before about 72 hours after the application; the length of this interval is, however, modified to some extent by the temperature, moisture content, and type of the soil used, the formaldehyde escaping more freely from warm, dry soils than from cold, wet ones. The liability to injury also decreases as the organic content and particle fineness of the soil increase.

Much of the injury to plant cuttings which results from attacks of the damping-off organisms was also prevented by treating the sand in the cutting bench at the rate of 3 oz. of the 6 per cent. formaldehyde dust per cu. ft. The sand should be thoroughly stirred at the end of 24 hours after treatment, and the cuttings may be set after 48 hours.

The dust treatment was shown to kill *P. de Baryanum*, *Sclerotium delphinii*, *Fusarium lycopersici* (from tomato), and the mycelium (but not the sclerotia) of *C. solani*, when used in soil containing these fungi.

TASCHER (W. R.). **Experiments on the control of seed-borne diseases by X rays.**—*Journ. Agric. Res.*, xlvi, 10, pp. 909–915, 1933.

The results of experiments with cultures of *Fusarium moniliforme* [*Gibberella moniliformis*], *Cephalosporium acremonium*, *G. saubinetii*, and *Diplodia zeae* indicated that these fungi varied in their susceptibility to the action of X-rays from relatively high resistance in the first to high susceptibility in the last-named. *D. zeae*, however, was found to be extremely resistant when present in dormant maize seed, presumably owing to its inactive condition, the presence of resistant spores, and to the absorption of the radiating energy by the seed tissues. The greater resistance of the other three organisms may also be possibly explained by the presence of spores in the pure cultures. Further experiments on the possibility of controlling the diseases of maize caused by *D. zeae* and *G. saubinetii*, bunt (*Tilletia levis*) [*T. foetens*] and loose smut (*Ustilago tritici*) of wheat, and the loose smuts of barley and oats (*U. nuda* and *U. avenae*) by X-raying the seed-grains gave negative results with dormant seed, but the treatment of germinating seeds significantly reduced the percentage incidence of *U. avenae* and completely controlled *U. nuda*; the germination of the seed, however, was very adversely affected by the treatment, and was reduced to as low as 5 per cent. of the controls in barley.

Incidentally it was shown that organic mercury treatment [*R.A.M.*, vii, p. 713] of maize seed partially controlled *D. zeae* but appeared to be ineffective with *G. saubinetii*. There was no evidence of stimulation in any of these treatments.

PAINE (S. G.), LINGGOOD (F. V.), SCHIMMER (FREDA), & THRUPP (T. C.). **The relationship of micro-organisms to the decay of Stone.**—*Phil. Trans. Roy. Soc.*, London, Ser. B, ccxxii, 486, pp. 97–127, 5 pl., 1 fig., 1 graph, 1933.

After giving an account of various bacterial organisms isolated

from decaying stone, a form of decay is described which is characterized by masses of white deposit 1 to 2 mm. below the surface, causing the stone to flake away, so that the deposit remains exposed to the air. The white incrustation is sometimes accompanied by a brown discoloration of the decayed stone.

In a sample of this type of decay the stone was found to harbour a bacterial organism or allied group of organisms capable of oxidizing sulphides and thiosulphates with the formation of sulphuric acid. A search for these bacteria in other examples where decay was accompanied by a crystallization of calcium or sodium sulphates gave positive results for sandstones from numerous buildings, sand which had fallen down a chimney, limestones, a decaying Portland stone, brickwork, and terra-cotta. Although found in a great majority of the cases, these bacteria are not considered as invariably responsible for the formation of the sulphates, which can adequately be explained in certain circumstances on chemical and physical grounds.

The organism grew well on plates of washed agar containing mineral salts, including sodium thiosulphate and precipitated chalk. At 28° C. the colonies appeared in about two weeks, the surface colonies being round and the deep ones spindle-shaped. They gradually became surrounded by a clear halo in which the chalk was dissolved by the sulphuric acid produced, while they also showed a dense, cyst-like, yellowish-brown centre surrounded by a clear, wide envelope of mucilage. The yellow colour of the central zone was found to be due to sulphur granules, while both the outer and inner regions contained masses of minute cocci, 0·28 $\mu$ in diameter. It is believed that this organism is commonly present in dust.

Inoculations demonstrated that the bacteria caused a loss of weight in stone, with the removal of calcium sulphate. In one experiment a column of Bath stone 4 in. long by 1 in. square section, was inoculated and fed with a solution containing 2·5 gm. thiosulphate per litre, uninoculated controls receiving the same treatment. The solution was allowed to drip on to a muslin cap and after passing over the surface of the column, was collected and the sulphate determined. At the end of the experiment the columns were allowed to dry, when a blister consisting of a thin, brown skin was found to have formed along the line of flow on the inoculated stone. When the skin was removed it was observed that some of the oölites at the surface of the stone had been carried away with it, some having actually split in the process. The skin was composed of the mucilage of the bacterial zoogleae which had developed on the surface. The tearing of the surface indicates a possible way in which the sulphur-oxidizing bacteria may disintegrate stone, quite apart from the solvent action of the sulphuric acid excreted.

There is a bibliography of 28 titles.

COTTAM (C.). **Disappearance of Eel Grass along the Atlantic coast.**—*Plant Disease Reporter*, xvii, 6, pp. 46–53, 1933. [Mimeographed.]

In 1931–2, following almost unprecedented drought, low tides,

and calm weather, large areas of grass-wrack seaweed or 'eel grass' (*Zostera marina*) rapidly disappeared from numerous localities along the Atlantic seaboard of North America. In most of the areas affected the leaves, during the midsummer of 1931, became dark, broke from their roots and floated ashore in masses. The disappearance of the eel grass was observed from New Jersey to Maine before it became apparent north or south of this stretch of coast; part of the Maine coast appears to have been affected at least as early as 1930. There now exists an unprecedented scarcity of living eel grass on the coast of Nova Scotia, Prince Edward Island, and along all but the extreme north of the coast of New Brunswick. As the disease has been active for two years in the Bay of Fundy, it is not unlikely to spread to the northern part of the Gulf of St. Lawrence.

The virulence of the attack varies considerably in different localities. Badly affected plants appear as if wilting and disintegrating. The attacks generally begin as one or more greyish-brown spots on a leaf margin [*R.A.M.*, xii, p. 308], the outermost leaves and sheaths usually being affected first. The leaf turns brown and dies, death and disintegration commonly progressing from tip to base. The affected part frequently extends for a considerable distance down one margin or a large vein before spreading across the leaf. The brownish, later blackish, areas are especially noticeable on the rhizomes, which readily become black, fragile, and spongy, and soon break apart at the nodes. Occasionally, the disease appears to have progressed upwards from a diseased rootstalk, in which case the outer portions of the plant are affected first.

Though bacteria were present in some of the diseased tissues [loc. cit.] no evidence was obtained that they were the cause of the condition.

ELFORD (W. J.). **The principles of ultrafiltration as applied in biological studies.**—*Proc. Roy. Soc.*, London, Ser. B., cxii, 778, pp. 384–406, 1 pl., 1 fig., 7 graphs, 1933.

Using a series of graded collodion membranes termed 'gradocol' the author studied the effect of various factors on the filtration of suspensions of fine particles and colloids. Filtration through these membranes begins to be impeded at a pore size two to three times greater than that which absolutely prevents passage. It had already been determined that a pore size less than 0·75 $\mu$ effectively retains *Bacillus prodigiosus* (0·5 to 1 $\mu$ in diameter) suspended in broth at $P_H$ 7·6, and further work showed that the limit of permeability varied with the concentration of the suspension. With dye solutions over a tenfold variation in initial concentration the relationship was one of slightly less than inverse proportionality. With membrane pores of less than 1 $\mu$ in diameter the particle/pore-size ratio decreases, until for a 10 $\mu\mu$ pore particles of half this size are retained.

Increase in the membrane thickness or area increases the adsorbing surface proportionally. Under otherwise comparable conditions the adsorption in filtration is proportional to the membrane thickness and surface area. At low pressures the apparent

adsorption is rather more than directly proportional to the membrane thickness.

Where the initial adsorption stage is of negligible proportions, increasing the filtration pressure merely increases the rate of filtration. Where the effects of surface forces are appreciable the influence of pressure may be very marked in the early stages of filtration.

To determine the end-point in membrane permeability for a given suspension it is necessary to establish the percentage-concentration/volume of filtrate curves for membranes of progressively lower porosities under standard conditions. It is then possible to ascertain the point at which surface forces of adsorption and cohesion begin to exert an abnormal influence upon the course of filtration. This indicates that the end-point is being approached, and coincides with a rapid decline in the rate of filtration, owing to the membrane becoming choked. The filtration curves from this point onwards require to be very carefully studied, selecting conditions most favourable to filtration until the value of the true filtration end-point is found. The sharpness with which the end-point is defined depends upon the regularity of membrane structure and the uniformity of dispersion in the system being filtered.

As the determining factors in filtration cannot be accurately assessed independently, it is only possible to express the probable limits for the size of the smallest particle just retained by a given membrane, as obtained under the best available conditions for filtration. This has been worked out for several animal viruses, oxyhaemoglobin, egg albumin, and gold sol. The limits thus obtained are compared with those determined microscopically and by other methods, and show a fair measure of agreement. Thus the size of the virus of infectious ectromelia from filtration data was 0·10 to 0·15 $\mu$, subsequent measurements of photographs of the bodies giving 0·13 to 0·14 $\mu$. The probable size of the elementary virus units of vaccinia virus was found to be 0·125 to 0·175 $\mu$ by filtration, the maximum size as measured by means of ultraviolet light photography being 0·17 to 0·18 $\mu$.

SMITH (K. M.). **The present status of plant virus research.**—*Biol. Reviews*, viii, 2, pp. 136–179, 1 pl., 1933.

This paper gives a brief general survey of work in the study of plant virus diseases mostly during the last 20 years and, taken in conjunction with the author's previous review [*R.A.M.*, x, p. 808], its object is to help to relate to one another some of the many apparently contradictory facts in the extensive relevant literature [some 300 titles are cited in the bibliography appended], and thus reveal any new principles at present obscured by a redundancy of facts. The chief methods of approach to this study are discussed under the following headings. (A) Physical properties of the viruses, namely, their reaction to heat, chemicals, dilution, purification, filtration, adsorption, ageing *in vitro*, and light. (B) Symptomatology, including the histology of the healthy and diseased plants. (C) Various methods of transmission. (D) Attempted cultivation *in vitro* of a plant virus, and of some supposed causal organisms of virus diseases. (E) Movement of the

virus within the host plant. (F) Metabolism of the virus-affected plants. (G) Photography of the viruses by ultra-violet light. (H) Some other aspects of the behaviour of virus-affected plants. (I) Electric charge of virus particles.

In the next two chapters the author discusses the application of some of the above-mentioned methods to the differentiation of the various viruses, and points out that much of the confusion now existing in this subject is due to the fact that most of the authors have attempted to name the disease instead of the virus and have not made a sufficiently clear distinction between the disease and its causative principle; some of the more recent work on the potato mosaic group is then discussed in detail. In a reply to Murphy's criticisms of his work on the *x* and *y* viruses [ibid., xi, p. 738] he states that they appear to be partly based on a misapprehension of the use of the words 'streak', 'crinkle', and 'mosaic', which were used by him to designate each a set of symptoms, while Murphy uses them to designate a specific virus. While agreeing with the latter that, besides these two potato viruses, there also exists another—virus A [ibid., xi, p. 740], and also an independent virus occurring as Up-to-Date streak, he considers that the variations noticed in the symptoms produced by the *x* virus on tobacco [nineteen types of which are illustrated in the plate appended] would suggest that they are due to the existence of variants of a single virus, which probably are not constant mutations. The position thus seems to be that there are at least five, and possibly more, distinct potato mosaic viruses, namely the author's *x* and *y*, the A virus of Murphy & M'Kay, Salaman's paracrinkle, and the Up-to-Date streak virus. As regards the insect vectors of these viruses, so far the virus *y* alone has been definitely shown to be efficiently transmitted by the aphis *Myzus persicae*, and there is no clear evidence of the method of transmission in nature of the others.

DUGGAR (B. M.). **Standardization and relative purification technique with plant virus preparations.**—*Proc. Soc. Exper. Biol. & Med.*, xxx, 8, pp. 1104–1109, 1933.

A description is given of the writer's tentative standard method for the relative purification of the tobacco mosaic virus [*R.A.M.*, vii, p. 525].

The crude juice from diseased plants is obtained by grinding the leaves and young stems in a food mill and expressing the juice through a double thickness of cheesecloth. This full-strength juice may be diluted with 9 parts of distilled water, to which is added with stirring 10 gm. of celite (a special product of the nature of diatomaceous earth; the finer commercial grades of the latter may also be used) per 100 c.c. of diluted juice. After 30 minutes' standing, with frequent shaking, the preparation is centrifuged at about 4,000 revolutions per minute for four to five minutes. The celite treatment has no marked influence on the activity of the tobacco mosaic virus, the infectiousness of the filtered celite-treated juice being little less than that of the unfiltered controls and averaging 90 to 100 per cent. at a dilution of 1 in 1,000. It was shown by a test with a 12 cm. Mandler filter

candle that the viscous materials in the natural juice markedly impeded the passage of the virus particles across the walls of the filter.

WOLFF (H.). **Zur Assimilation atmosphärischen Stickstoffs durch die Wurzelpilze von Corallorrhiza innata R. Br., sowie der Epiphyten Cattleya bowringiana Veit und Laelia anceps Ldl.** [On the assimilation of atmospheric nitrogen by the root fungi of *Corallorrhiza innata* R. Br., and by those of the epiphytes *Cattleya bowringiana* Veit and *Laelia anceps* Ldl.]—*Jahrb. Wissensch. Bot.*, lxxvii, 5, pp. 657–684, 1933.

The author succeeded in isolating the endophyte of *Corallorrhiza innata* and also grew those of *Cattleya bowringiana* and *Laelia anceps*. The first of these resembled the endophyte of *Neottia* (*Orcheomyces neottiae*) [*R.A.M.*, vi, p. 744] and the others were as described by Burgeff [*Rhizoctonia repens*: ibid., v, p. 177; xii, p. 583].

In pure culture the endophyte of *Corallorrhiza innata* utilized glucosides (e.g., tannin) and hexoses (glucose). The assimilation of elementary nitrogen from the air was quantitatively determined and found to amount to 0·24 to 0·84 mg. in 100 c.c. nutrient solution per 100 days of culture and about 35 to 190 mg. dry weight. The endophytes of *Cattleya bowringiana* and *L. anceps* utilized glucosides (tannin), hexoses (glucose, mannose, salep solution), and pentoses (arabinose). Atmospheric nitrogen was also fixed by these organisms at the rate of 0·23 to 0·96 mg. in 100 c.c. nutrient solution per 100 days and 40 to 120 mg. dry weight. By means of its hyphae the endophyte of *Corallorrhiza innata* is enabled to assimilate the carbohydrates in the soil and to supply them, together with nitrogen, to its host, which is practically devoid both of chlorophyll and of roots.

SCHAEDE (R.). **Über die Symbionten in den Knöllchen der Erle und des Sanddornes und die cytologischen Verhältnisse in ihnen.** [On the symbionts in the nodules of the Alder and of the Sea Buckthorn and their cytological relations.]—*Planta*, xix, 2, pp. 389-416, 19 figs., 1933.

A detailed account is given of the writer's studies on the cytology of the endophytic Actinomycetes associated with the root nodules of alder (*Alnus japonica* and *A. glutinosa*) [*R.A.M.*, xii, p. 312] and sea buckthorn (*Hippophaë rhamnoides*), the two former growing in the Breslau Botanic Gardens and the latter being sent from the island of Rügen.

At a certain stage in the development of the *Actinomyces* (that of *H. rhamnoides* closely resembles that of the alders), they are completely absorbed by the hosts so that only the membranes are left. The nuclei of the infected cells first increase and then decline in size. Gradually the infected cells die off and their plasmatic content is absorbed by the adjacent cells.

The 'bacteroids' accompanying *Actinomyces* sp. in the nodules of *A. glutinosa* are considered to represent a stage in the development of the former and to originate from the disintegration of the filaments into small clumps. The cells in which the bacteroids

occur are dead and contain neither cytoplasm nor nuclei. At this stage the symbiotic relationship between the endophyte and its host is lost, the former ceasing to develop in the shape of hyphae and vesicles and the latter being unable to digest the assimilatory products of the symbiont.

MITTMANN (GERTRUD). **Kulturversuche mit Einsporstämmen und zytologische Untersuchungen in der Gattung Ceratostomella.** [Culture experiments with monospore strains and cytological investigations on the genus *Ceratostomella*.]—*Jahrb. Wissensch. Bot.*, lxxvii, 2, pp. 185–219, 45 figs., 1932.

A comprehensive account is given of the writer's cultural and cytological studies, conducted at the Tübingen Botanical Institute, on *Ceratostomella fimbriata*, *C. coerulea*, and *C. quercus* Georgevitch [*R.A.M.*, vii, p. 286], the first two from the Centraalbureau voor Schimmelcultures, Baarn, and the third from a Suabian oak wood, the trees of which have been severely affected during the last 20 to 30 years by canker-like blisters and wounds. *C. fimbriata* and *C. quercus* were shown to be homothallic and *C. coerulea* heterothallic [cf. ibid., viii, p. 227].

HOMMA (YASU). **Homothallism in Sphaerotheca fuliginea (Schlecht.) Pollacci.**—*Proc. Imper. Acad.*, Tokyo, ix, 4, pp. 186–187, 1 fig., 1933.

In order to verify the conclusions of Harper (1905) and Dangeard (1907) regarding homothallism in *Sphaerotheca fuliginea* [*S. humuli* var. *fuliginea*: *R.A.M.*, x, p. 500], the writer carried out a series of inoculation experiments at the Hokkaido University, Sapporo, with single conidia of this organism on *Taraxacum ceratophorum* plants grown in pots and covered with glass. Four plants out of the 23 inoculated contracted infection and perithecia developed on the mycelial plaques. A cytological examination showed that both the ascogonial and antheridial hyphae are formed on the single mycelium derived from the monosporic infection.

HÜTTIG (W.). **Über physikalische und chemische Beeinflussungen des Zeitpunktes der Chromosomenreduktion bei Brandpilzen.** [On the physical and chemical factors influencing the moment of chromosome reduction in the smut fungi.]—*Zeitschr. für Bot.*, xxvi, 1, pp. 1–26, 2 figs., 7 graphs, 1933.

Two methods of fusion occur between the promycelial cells in *Ustilago avenae* from oats and *U. decipiens* from *Arrhenatherum elatius* according to whether the reduction division takes place in the first or second division of the promycelium [cf. *R.A.M.*, xii, p. 17]. By observing the proportion of these methods in germinating spores under experimental conditions, the effect of various factors on the moment of the reduction division was ascertained.

No influence was exerted by modifications in the vapour tension, osmotic pressure, or hydrogen-ion concentration of the medium. The optimum temperature for the development of the promycelium in *U. avenae* lies between 22° and 25° C. and for *U. decipiens* round about 20°, the greatest number of cases in which the reduction occurs in the first division being at 13° for *U. decipiens*

and at 25° for *U. avenae*. The urethanes impeded or suppressed reduction in the first division, while various other alkali salts stimulated the process in a more or less irregular fashion, the sodium salts being exceptional in that they exerted a fairly constant inhibitory action at all the concentrations tested.

DIX (W.) & RAUTERBERG (E.). **Die Sterilisation des Bodens mit Hilfe des elektrischen Stromes.** [The sterilization of the soil with the aid of the electric current.]—*Arch. für Pflanzenbau*, A, x, 2, pp. 172–190, 1 fig., 1933.

In connexion with an investigation at Kiel, Germany, on the possibilities of soil sterilization by electricity [cf. *R.A.M.*, xi, p. 589], the writers found that the potato wart fungus [*Synchytrium endobioticum*] withstood a current of 2,750 volts and 3·5 amperes. The fungus can be completely destroyed by five minutes' heating of the soil to between 90° and 100° C., and electrical methods for this (which are, however, too costly for present use) are fully discussed from the technical and economic standpoints.

EICHINGER. **Kartoffelschorf und Düngung. III.** [Potato scab and fertilizing. III.]—*Superphosphat*, ix, p. 2, 1933. [Abs. in *Fortschr. der Landw.*, viii, 13, p. 308, 1933.]

Continuing his observations on the incidence of potato scab [*Actinomyces scabies*] in relation to various systems of fertilizing in Germany [*R.A.M.*, xi, p. 597], the writer found in 1932 that the disease may be checked by the application of potassium bisulphate-magnesia, superphosphate, and ammonium sulphate. Top dressings of lime exerted no injurious effect.

**Potato scab and Rhizoctonia and their control.**—*Amer. Potato Journ.*, x, 4, pp. 65–73, 1933.

W. P. Raleigh and R. Bonde report an average increase in the potato yields of 17 barrels per acre as a result of seed treatment in 1932 against *Rhizoctonia* [*Corticium*] *solani* on Aroostook Farm, Maine [see above, p. 613]. The best results were given by three minutes' immersion in mercuric chloride, with or without the addition of 1 per cent. hydrochloric acid [*R.A.M.*, xii, p. 530]. Irish Cobblers grown on the farm for five seasons and selected for freedom from *C. solani* showed only a trace of infection even without treatment.

R. W. Goss states that the only reliable means of controlling scab [*Actinomyces scabies*] in Nebraska is the hot formaldehyde treatment, which is not, however, so effective against *C. solani* as mercuric chloride. Consequently it is advisable to use the former treatment in the western part of the State, where scab is very important, and the latter (or improved semesan bel) in the eastern and south-central regions, where *C. solani* is prevalent and often followed by blackleg [*Bacillus phytophthorus*].

The following results were given by disinfection experiments by C. F. Taylor and L. L. Stirland of Cornell during the past four years. The average yield increases for mercuric chloride, yellow oxide of mercury, and calomel have been 10·3, 11·3, and 9·7 bushels per acre, respectively. The inorganic mercury compounds have

given the greatest reduction in the percentage of tubers bearing sclerotia of *C. solani*. When the plants were a few inches high, there was an average of 39 out of 100 fewer rotted seed pieces on the yellow oxide-treated plot than on the untreated, the corresponding figures for mercuric chloride and calomel being 12 and 14, respectively. During the past two years the following increases of scab followed the use of mercurial compounds in the high limestone regions of New York State where this disease is serious: hot mercuric chloride 8 per cent., yellow oxide 8·3, semesan 1·5, and cold mercuric chloride 1·2. The increase in the disease occurred whether the mercury was added to the fertilizer or used as a tuber dip. Cold and hot formalin reduced the incidence of scab by 9·1 and 3·8 per cent., respectively, compared with the untreated. It is evident from these data that formaldehyde is preferable to the mercury disinfectants where soil-borne scab is an important factor, but in acid soils yellow oxide of mercury (1 lb. per 15 galls. water) or hot mercuric chloride may be recommended.

*A. scabies* is believed by P. E. Tilford to occur naturally in certain parts of Ohio, having infested a potato crop planted on land put into cultivation for the first time after forty years.

B. J. Dippenaar found that, under Wisconsin conditions, the application of sulphur to the soil at the rate of 300 to 900 lb. per acre is effective against scab when combined with liberal irrigation of the soil. In a naturally infested peat soil, the average number of lesions per tuber in a plot where the moisture was kept at 85 per cent. of the water-holding capacity was only 7·5 as compared with 62 at 40 per cent. [ibid., xii, p. 389]. In general, very little scab occurs in soils with a reaction of $P_H$ 5·3 or lower, whereas above 5·5 the disease may be severe [cf. ibid., xii, p. 189]. In greenhouse tests it was found possible to control scab by changing the soil reaction from $P_H$ 5·8 to 5·17 by sulphur applications before the setting of the tubers.

R. E. Vaughan recommends the acid mercury dip for the control of scab and *C. solani* in Wisconsin. In 1932 this treatment gave 82 and 97 per cent. freedom from *C. solani* in the five- and ten-minute dips, respectively, the corresponding figures for mercuric chloride ($1\frac{1}{2}$ hours), cold formaldehyde, and untreated being 52, 36, and 16 per cent., respectively. The incidence of severe infection by *C. solani* was only 1 per cent. for the ten-minute acid mercury dip as compared with 34 and 36 per cent., respectively, for cold formaldehyde and untreated. Hot formaldehyde gives good control of both diseases but causes a heavy reduction of germination.

MEYER-HERMANN (K.). **Beobachtungen und Untersuchungen über die Eisenfleckigkeit der Kartoffel.** [Observations and studies on Potato spraing.]—*Fortschr. der Landw.*, viii, 9, pp. 200–205, 1 fig., 1933.

The writer summarizes his observations on spraing of potatoes in the Cassel district of Germany, and discusses the problem of the increasing prevalence of this disease in the light of contemporary studies [*R.A.M.*, xii, p. 391].

It is evident that soil conditions play an important part in the development of spraing, but the nature of their influence has been

variously interpreted. Appel, in his 'Taschenatlas der Kartoffelkrankheiten' (I Teil: Knollenkrankheiten), Berlin, P. Parey, 1925, states that the disease occurs mostly on heavy, ferruginous soils, sometimes also on those with a tendency to incrustation. In Hungary J. Tabacs (*Növenyvéd.*, vi, p. 155, 1930) also found spraing on compact soils. E. Riehm and M. Schwartz (*Mitt. Deutsch. Landw.-Gesellsch.*, p. 157, 1927) attribute it to soil acidity and lime deficiency, whereas Schlumberger regards the disease to some extent as a consequence of alternating drought and moisture on light soils (*Die Kartoffel*, xi, p. 229, 1931). Atanasoff's observations in Holland are also summarized [*R.A.M.*, vi, p. 179]. The author found the disease exclusively on light sandy soils, rich in humus, among over 100 samples of all types examined, and notes its absence from swampy soils and from those consisting of a clay-sand mixture. No correlation could be detected between the soil reaction and the disease, which has been most prevalent in wet years such as 1930 and 1931. The nature and amount of the fertilizers applied to the potato fields appear to be of minor importance. Spraing occurred on a gravelly, red, ferruginous soil brought into cultivation for the first time in 1931, so that the disease is evidently not dependent on a preceding crop.

In the districts under the author's observation, Direktor Johanssen and Erdgold potatoes are so severely affected that their cultivation is scarcely practicable, the following varieties being involved in a decreasing extent as named: Sickingen, Kaiserkrone, Deodara, Parnassia, Rosafolia, Maibutter, and Ackersegen, while Preussen is apparently immune. Large tubers tend to show more spraing than small ones, while late harvesting also appears to increase its incidence. No evidence of seed transmission was obtained.

Under the terms of the German potato trade regulations (1930), seed potatoes cannot be rejected on account of spraing except by special arrangement, but such material is frequently difficult to dispose of and fetches a low price. In Switzerland (*Die Kartoffel*, p. 174, 1932) the purchaser is entitled to a rebate on consignments with more than 20 per cent. of spraing unless he has expressly agreed to accept them in this condition, while those affected to the extent of over half (by weight) may be rejected.

Müller (K.). **Einiges über Kartoffelkrankheiten.** [Notes on Potato diseases.]—*Die kranke Pflanze*, x, 4, pp. 56–57, 1 fig., 1933.

A brief, popular note is given on the reduction of the German potato harvest in 1932 through scab [*Actinomyces scabies*], late blight (*Phytophthora infestans*), and spraing [see preceding abstract], the last-named being particularly severe on the Erdgold and other new varieties, many consignments of which were rejected on account of the disease.

Blodgett (F. M.), Mader (E. O.), Burke (O. D.), & McCormack (R. B.). **New developments in Potato spraying.**—*Amer. Potato Journ.*, x, 5, pp. 79–88, 3 graphs, 1933.

This is an extended and tabulated account of the writers' four

years' spraying experiments [against *Phytophthora infestans* and other diseases and pests] on Rural potatoes in New York State and on Green Mountains in Long Island [*R.A.M.*, xii, p. 390]. In New York the best results were obtained by Bordeaux mixture at the rate of 75 to 80 lb. copper sulphate per acre applied at 400 lb. pressure, the amount required on Long Island apparently being somewhat less. The yields improved with a decrease in the amount of lime in the Bordeaux mixture, the ratio recommended being 5 lb. copper sulphate and 2½ lb. lime per 50 galls. water.

MOORE (H. C.) & WHEELER (E. J.). **Spraying and dusting Potatoes in Michigan.**—*Michigan Agric. Exper. Stat. Special Bull.* 234, 23 pp., 11 figs., 1933.

In tests carried out during 1927–8 spraying potatoes with Bordeaux mixture against early and late blight [*Alternaria solani* and *Phytophthora infestans*] and insect pests resulted in an average increase of yield on 22 farms of 38 bushels of U.S. No. 1 tubers per acre [*R.A.M.*, xii, p. 240]. In six years' experiments Bordeaux-sprayed plots out-yielded those dusted with copper-lime by 13·7 bushels per acre for Russet Rurals and 20·86 for Irish Cobblers. Home-mixed dust was cheaper by $1·41 per acre than factory preparations and equally effective in five years' trials. No significant differences in yield were obtained in eight comparative experiments with hand, traction, and power dusting outfits. At the Lake City potato experiment farm, dust applications of 30 lb. per acre gave better results than lighter ones. Hydrated lime proved equally efficacious with quicklime in the preparation of Bordeaux mixture; it is recommended for Michigan growers as being readily procurable and both quick and easy in handling. 'Instant' and standard Bordeaux gave comparable results, but the former saves time and labour, since stock solutions are unnecessary. In two years' trials 300 lb. pressure was more effective than 150 or 450 lb. Spraying with Bordeaux was cheaper than dusting with copper-lime by $3·70 per acre. At least five and preferably seven or more applications should be made at seven- to ten-day intervals throughout the growing season, beginning when the plants are about 4 in. high.

BROWN (B. E.), HOUGHLAND (G. V. C.), SMITH (O.), & CAROLUS (R. L.). **The influence of magnesium on different Potato soil types.**—*Amer. Potato Journ.*, x, 4, pp. 55–65, 1 map, 1933.

Potatoes in Maine, New York, New Jersey, Virginia, and elsewhere are liable to be affected by a well-defined disturbance of growth associated with chlorosis of the leaves (especially the lowest), which in severe cases turn brown, thicken, harden, and finally die. The discoloration starts at the leaf margin and gradually involves the entire surface.

In most cases the diseased plants were found to be growing on very acid soils ($P_H$ 4·2 to 5), the reaction being further accentuated by the use of ammoniacal nitrogen; under such conditions the leaching of basic compounds, such as lime and magnesium, might

reasonably be expected. Field studies in Aroostook County, Maine, confirmed this supposition, and on Norfolk sandy loam soil in Virginia highly beneficial results followed the addition of magnesium sulphate when the soil reaction was $P_H$ 4·2 though not at 5·5.

It is pointed out that the amount of magnesium in the water sources of the coastal plains sections of the Atlantic seaboard is much lower than elsewhere in the United States [cf. *R.A.M.*, xi, p. 470].

TULLIS (E. C.). **Ophiobolus oryzinus, the cause of a Rice disease in Arkansas.**—*Journ. Agric. Res.*, xlvi, 9, pp. 799–806, 1 fig., 1933.

This is the full report of the author's investigation of *Ophiobolus oryzinus* on rice in Arkansas, an abstract from which has already been noticed [*R.A.M.*, xi, p. 469]. The disease rots the lower leaf sheaths, on the inner surface of which dark reddish-brown mycelial mats may be found, while perithecia develop in the discoloured tissues. The culms are also invaded but do not bear perithecia in the field. In some varieties the tissues at the crown may also be killed. Cultures are readily obtained, and the fungus was found to be homothallic. In young leaves penetration occurs without the formation of appressoria, but in older ones and the culm appressoria are first developed.

MURRAY (R. K. S.). **Further yield records in connection with Oidium heveae.**—*First Quart. Circ. for 1933, Rubber Res. Scheme (Ceylon)*, x, 1, pp. 1–8, 2 graphs, 1933.

This report summarizes the results obtained in 1932 in the continued sulphur dusting experiments for the control of mildew of *Hevea* rubber (*Oidium heveae*) on the Kandanuwara Estate, Ceylon [*R.A.M.*, xi, pp. 126, 401]. Owing to a mechanical breakdown of the apparatus, the dusted field could not be satisfactorily treated between 20th January and 2nd March, with the result that, despite applications of sulphur before and after this period, the condition of the dusted trees during the season was very little superior to that of the controls, the intensity of the disease being as great in 1932 as in previous years. In spite of the latter fact, the yield of the individual trees per tapping in the control field increased from 0·31 oz. in 1931 to 0·35 oz., indicating that the conditions of 1932 were relatively favourable for yield. On the other hand, in the dusted field the yield per tapping fell slightly from 0·51 to 0·49 oz., presumably owing to the partial failure of the dusting operations, entailing a slower normal recovery in yield of the treated trees after wintering. The fact that, notwithstanding the adverse conditions, the yield per acre was still higher in the dusted field than in the control, a reversal of the position in years prior to the adoption of control measures, is considered to show that although sulphur dusting cannot be neglected in any one year without detriment to the trees, the benefits to the general health of the latter conferred by previous years' treatments are to some extent cumulative.

MA (ROBERTA M.). **A study on the soil fungi of the Peking district.**—*Lingnan Sci. Journ.*, xii (Supplement), pp. 115–118, 1933.

During the year 1931–2 the writer analysed the fungus flora of soil samples from rice, wheat, and millet fields, grass lands, and garden and hillside soils in Peiping West (Peking district).

Sixty-six species of fungi in 23 genera were determined, *Aspergillus* and *Penicillium* predominating, as in western countries, both in numbers (17 and 15 species, respectively), and in frequency of occurrence throughout the year. *Rhizopus nigricans*, *Trichoderma album*, *T. koningi*, *T. lignorum*, *Gliocladium fimbriatum*, and *G. penicilloides* were found in rice and wheat fields and garden soils, and *Hormodendrum cladosporioides* [*R.A.M.*, xi, p. 375], *H. olivaceum*, and *H. pallidum*, *Alternaria humicola* [ibid., vii, p. 471], *Fusarium* spp. (including *F. lini*), *Acrothecium robustum*, *Acrostalagmus* spp., and *Amblyosporium echinulatum* in various garden soils, millet fields, and grass lands. Other fungi were more or less restricted to certain fields at definite times of the year.

**Gulspidssyge.** [Yellow tip disease.]—*Statens Forsøgsvirksomhed i Plantekultur, Medd.* 144, 4 pp., 2 figs., 1933.

A brief, popular note is given on the occurrence in Denmark (almost exclusively in Jutland) of the 'yellow tip' [reclamation] disease of oats, barley, red clover [*Trifolium pratense*], lucerne, field peas [*Pisum arvense*], broad beans [*Vicia faba*], and swedes, and on its control by the application to the soil in spring of 50 kg. copper sulphate per hect. [*R.A.M.*, xi, p. 767]. The beneficial effects of this treatment last for three to four years. The copper sulphate may be mixed with ammonium sulphate, potash, potassium sulphate, or sand to facilitate application. The use of lime tends to promote the reclamation disease and should be discontinued in the affected areas, where an admixture of clay or marl with the soil is advisable. Grey and bog oats are more resistant than the white varieties and spring rye may also safely be cultivated.

CHUPP (C.). **Downy mildew of Hops in New York.**—*Plant Disease Reporter*, xvii, 8, pp. 103–104, 1933. [Mimeographed.]

A survey made in June 1933 of the few hop gardens now existent in New York State showed that in all *Pseudoperonospora humuli* [*R.A.M.*, xii, p. 325] was sparsely present on the lowest leaves of plants a year or more old, though no damage had been done except in one garden. Infection was most marked where the small shoots had been carelessly removed from the crowns. A few plants were found with symptoms resembling mosaic.

BRESSMAN (E. N.) & NICHOLS (R. A.). **Germination of the oospores of Pseudoperonospora humuli.**—*Phytopath.*, xxiii, 5, pp. 485–487, 1933.

Using the method devised by Hiura for the germination of the oospores of *Sclerospora graminicola* [*R.A.M.*, ix, p. 774], the writers obtained prompt germination of the oospores of downy mildew of hops (*Pseudoperonospora humuli*) from leaves collected two years

previously and kept dry in the laboratory at Corvallis, Oregon [ibid., ix, p. 59].

Germinated oospores had formed sporangia and emitted zoospores in less than 36 hours from sowing and six young Late Cluster seedlings inoculated in the greenhouse with these zoospores on 28th December, 1932, showed unmistakable evidence of mildew on 2nd January, 1933. On 1st January incipient zoospore formation was also found on similar leaf material that had been soaking in water for several days. Eight Fuggles seedlings were inoculated with these zoospores on the same day, and by 4th January all were heavily infected.

The germ-tube, about twice the diameter of the oospore in length, developed at its tip a sporangium similar to the summer ones, and containing more than 30 zoospores. The oospores measured approximately 30 $\mu$ in diameter, the sporangia 26 by 31 $\mu$, and the bean-shaped zoospores 5 to 7 $\mu$.

RUNNELS (H. A.) & WILSON (J. D.). **Control of the Alternaria blight of Ginseng with Bordeaux mixture and injuries accompanying its use.**—*Ohio Agric. Exper. Stat. Bull.* 522, 16 pp., 4 figs., 1933.

This bulletin embodies the results of continued experiments on the control of the blight due to *Alternaria panax* on ginseng (*Panax quinquefolium*), which confirmed those discussed in previous communications [*R.A.M.*, x, pp. 58, 807]. They also showed that besides intensifying the drought injury to the plants, as previously described, improperly prepared Bordeaux mixture causes a serious leaf burn, and when applied in cold weather may cause an injury in which the wet tissues of young leaves are frozen, resulting in leaf killing or, if the injury is not so severe, in the deformation of later growth, involving the shredding of the leaf margins.

Soil moisture determinations in 1931 indicated that the critical soil moisture content at which drought injury became apparent on the leaves of sprayed plants ranged from 12 to 17·5 per cent. of the dry weight of the soil. In 1932 it was found that when plants just beginning to wilt from drought were sprayed with Bordeaux mixture, death of the leaves from drying out followed within 24 hours. This renders it advisable on non-irrigated soils to postpone spraying ginseng during drought periods until after the occurrence of a rain sufficiently heavy thoroughly to drench the soil.

COOK (M. T.). **Report on the international survey of the diseases of Sugar Cane.**—*Fourth Congress Internat. Soc. Sugar Cane Technologists, 1932, Bull.* 128, 15 pp., 1932. [Received July, 1933.]

From data furnished by a number of leading plant pathologists the writer has compiled a report on an international survey of sugar-cane diseases under the following aspects: historical; economic importance; transmission; environmental studies; varietal reaction; geographical distribution [cf. *R.A.M.*, viii, p. 809]; and problems suggested by the survey. A summary of the replies concerning most of the diseases listed is given and contains many

interesting notes on the identity, distribution, and spread of the pathogens.

McClean (A. P. D.). **Streak disease of Sugar Cane.**—*South African Sugar Journ.*, xvii, 5, pp. 247, 249, 251, 253, 255, 257, 259, 1933.

In this paper (read before the South African Sugar Technologists' Annual Congress) the present position concerning streak disease of sugar-cane in Natal [*R.A.M.*, xi, p. 603], is described.

A streak survey is in progress to determine the exact extent of infection in the various districts of Natal, and preliminary figures in respect of the south coast are already available. In Port Shepstone, where 13 fields covering 800 acres were inspected, the incidence of streak ranged from 75 to 100 per cent., the corresponding acreages and disease percentages for five other districts being as follows: Umzumbi 70, 99, Hibberdene 360, 11 to 55, Umtwalumi 1120, 20 to 50, Sezela 470, 66 to 90, and Esperanza 600, 3 to 83. In the first-named district streak was found to be as prevalent in the plant cane as in the ratoons, and no steps are taken to procure healthy material for planting. Further north the position improves and genuine efforts are made to control the primary spread of the disease. But in the Umbogintwini and along the Isipingo and Reunion flats the amount of infection in individual fields ranges from 20 to 100 per cent., at Stanger it is from 50 to 100 per cent., and in Zululand there are considerable areas where it is difficult to find any healthy plants. Where only healthy cane is used for planting the infection is much less. Thus, at Mount Edgecombe the percentages of streak in plant (521 acres) and ratoon (979) cane were 8 and 9, respectively, and at Tongaat (675 acres of plant and 749 of ratoon) 9·5 and 12·5, respectively.

At Mount Edgecombe a streak test has been proceeding for the last four years, four plots of 100 per cent. infected cane having been laid out alternating with four of cane raised from healthy seed. After two years 55 per cent. of the plants in the healthy plots showed infection and after four years 70 per cent.

In 1932 streak developed for the first time in the Co. 290 variety which, with P.O.J. 213, was hitherto believed to be immune. In Co. 290 the infection is apparently permanent, whereas in P.O.J. 213 attacks of the disease may be followed by partial or complete recovery. In the spring of 1933 five cases of streak were observed among P.O.J. 2725 in Zululand, a week or two after the receipt of a report from A. H. Rosenfeld of the occurrence of the disease on P.O.J. 2878, 2725, and 2714 in Egypt.

The paper was followed by a discussion.

McClean (A. P. D.). **The behaviour of the Cane variety P.O.J. 213 towards streak disease.**—*Fourth Congress Internat. Soc. Sugar Cane Technologists, 1932*, Puerto Rico, *Bull.* 27, 6 pp., 1 pl., [1932. Received August, 1933.]

The studies of the behaviour of streak disease [see preceding abstract] in the P.O.J. 213 variety of sugar-cane, an account of which is given in this paper, afford an insight into the reaction between the virus and a highly resistant host such as this variety.

The P.O.J. 213 cane was introduced into South Africa from the Argentine in 1914, and early in 1926 streak was observed on one plant for the first time. Two more diseased plants appeared in 1928 in the same plot as the first, and six others in 1929 in an adjacent plot. Forty-nine diseased stools were found in a field in the same locality in 1930.

Cuttings from shoots of P.O.J. 213 which were unquestionably streaked sometimes produced only healthy shoots and sometimes shoots which were at first streaked but later recovered, the recovery being, except for a few relapses, apparently permanent. From June or July onwards there was a general tendency for the streaking to increase to a maximum, then from December there was a progressive change towards recovery, until by March the shoots had either recovered or only a few, widely spaced streaks were noted on the youngest leaves. In some cases streak reappeared the following winter, gradually increasing to a maximum and disappearing again in the summer.

In transmission experiments with *Cicadulina mbila* on P.O.J. 213 plants, it was found that during the South African summer and autumn (October to May) the results were largely negative, while as winter approaches (May to July) some condition more favourable to the virus appeared to become established and there were several successful transmissions. In one experiment in which 3 plants out of 9 developed the disease the inoculations were made in March and the first signs of infection appeared in May. In others the incubation period was considerably longer. It appears also that under favourable conditions infection depends partly on the dose of the virus, and that the cumulative action of repeated doses (such as were given in the last-mentioned cases) may be necessary to overcome the resistance of the plant.

DASTUR (J. F.). **Sugar Cane mosaic.**—*Fourth Congress Internat. Soc. Sugar Cane Technologists, 1932,* Puerto Rico, *Bull.* 24, 4 pp., 2 pl., [1932. Received August, 1933.]

Sugar-cane mosaic was first recorded in India in 1921, when the author observed it at Pusa [*R.A.M.*, iii, p. 364]. Streak was later studied in the Central Provinces, the evidence obtained indicating that it had probably been introduced on canes from the cane-breeding station at Coimbatore, Madras. Further evidence that the disease is not indigenous to the Central Provinces is afforded by the fact that no fresh cases were found in the plots after the affected canes were either destroyed or not used for seed, even though the susceptible varieties were grown year after year.

In the Central Provinces there are ordinarily no secondary effects of streak on standing cane, and no reduction in the yield of molasses. Except for the leaf markings, a diseased crop in no way differs from a healthy one. On one experimental plot streak-infected cane which had been grown as ratoon year after year began to show the secondary symptoms (shortening of the internodes, splitting of the cane, and the development of adventitious roots from the top internodes) only after the sixth year of ratooning.

Notes are given on some cell inclusions found in diseased but

not in healthy canes. They are considered to be foreign bodies and to show certain similarities to those observed by Nelson in bean and other mosaics [ibid., ii, p. 227].

MATZ (J.). **Artificial transmission of Sugarcane mosaic.**—*Journ. Agric. Res.*, xlvi, 9, pp. 821–839, 1 fig., 1933.

After a brief review of the literature dealing with the nature of the sugar-cane mosaic virus and its transmission by artificial means [*R.A.M.*, ix, p. 678 *et passim*], the author describes an inoculation method devised by him, in which a drop of inoculum obtained by crushing young mosaic-infected suckers (of the P.O.J. 234 cane in the tests described) is deposited with a pipette in the wedge-shaped opening on healthy canes between the youngest expanded leaf blade and the next younger leaf on the same side of the leaf spindle; a very fine needle, set into a glass rod, is then passed horizontally, or somewhat obliquely downward, through the liquid and into the submerged area of the still rolled leaf, several vertical cuts with the needle being made through the leaf tissue, in order to allow of contact of the virus with the severed fine transverse connections of the vascular bundles. With fresh or properly stored inoculum this method is stated to have given high percentages of infection within a few weeks, although the juice left remaining at the point of inoculation was never protected from the air.

Evidence was obtained that expressed infective juice of the sugar-cane tends increasingly to lose its infectiousness when kept exposed to the air for a day or more at room temperature, or even at temperatures as low as about 4° C. When kept frozen, however, at a temperature of about $-6°$ in open beakers, the juice retained its full infectivity for as long as 27 days. It is advisable, therefore, in inoculation experiments, that the juice should be frozen as soon as feasible after preparation and be kept thus until thawed for use, and also that the grinding and pressing of the infected plant tissues should be done at as low a temperature as possible.

PARISI (ROSA). **Seconda contribuzione alla micologia dell'Italia meridionale.** [Second contribution to the mycology of southern Italy.]—*Bull. Orto Bot. R. Univ. Napoli*, x, pp. 155–175, [? 1932. Received August, 1933.]

This is an additional list of 101 species of fungi, mostly micromycetes, which the author has identified since her first communication [*R.A.M.*, iv, p. 313] as occurring in southern Italy, 51 of which are stated to be new records for that region. The following may be mentioned: *Uromyces trigonellae* on the leaves of *Trigonella foenum-graecum*, *Phyllosticta betae* on living leaves of beet, *Phoma chrysanthemi* on *Chrysanthemum indicum*, *Septoria gasparrini* on *Pistacia* sp., *Gloeosporium hesperidearum* on the fruits of *Citrus bigaradia* var. *canaliculata*, *Oidium cynarae* on *Cynara scolymus*, *Septoria ceratoniae*, *Ramularia australis*, and *Cercospora ceratoniae* on *Ceratonia siliqua*, *Helminthosporium inconspicuum* on the leaves of rye, and *H. sesami* on *Sesamum indicum*.

TAI (F. L.) & WEI (C. T.). **Notes on Chinese fungi. II.**—*Sinensia (Contr. Metrop. Mus. Nat. Hist. Acad. Sinica)*, iii, 4, pp. 93–130, 33 figs., 1932. [Received June, 1933.]

This is an annotated and illustrated list of 27 species of Erysiphaceae which have been recorded on some 90 hosts [an alphabetical list of which is appended] in China.

JENKINS (ANNA E.). **Additional studies of species of Elsinoe and Sphaceloma.**—*Mycologia*, xxv, 3, pp. 213–220, 2 pl., 1933.

In this paper the writer presents data on the identity, history, and host and geographic range of species of *Elsinoe* and of the form genus *Sphaceloma* [see above, p. 625].

The Italian fungus, *Hadrotrichum populi* [*R.A.M.*, xi, p. 724] var. *arbuti* on *Arbutus unedo*, is recognized as a *Sphaceloma* and as a synonym of *Illosporium mattirolianum*, necessitating the new combination, *S. mattirolianum*. Typical lesions of this fungus were found on phanerogamic herbarium specimens from Germany, indicating the presence of the organism in that country.

The American species *E. ledi* on Labrador tea (*Ledum groenlandicum*) [ibid., xi, p. 184] was described by Peck (*New York State Mus. Bull.* 150, p. 23, 1911) as *Aulographum ledi*, and has since been found on several species of *Ledum* from the east and west of the United States and from Newfoundland. The *Sphaceloma* stage accompanied the perfect form in several collections. In cultures on potato-dextrose agar at constant temperatures, *E. ledi* grew most profusely at 15° to 20° C., while the optima for the other species of *Elsinoe* and *Sphaceloma* are 20° to 25° or above.

The distribution of *S. symphoricarpi* on snowberry (*Symphoricarpos albus* Blake) [= *S. racemosus* Michx.: ibid., ix, p. 723] in Maine, Virginia, and California was ascertained through the examination of dried herbarium specimens of the host from these States.

GADD (C. H.). **The making of Tea cider.**—*Planters' Chron.*, xxviii, 7, pp. 150–151, 1933.

The author states that a good tea cider [see above, p. 597] can be prepared with cultures containing other yeasts than *Saccharomycodes ludwigii*, *Bacterium xylinum* being apparently the organism to which the characteristic flavour and odour of the beverage are due. At St. Coombs, Ceylon, brewing takes from two to three days; at higher elevations the process may be longer, at lower ones shorter. When the right flavour has been obtained, the infusion is filtered through a double thickness of linen and bottled. The bottles must be completely filled and securely stoppered, as the liquid is effervescent. As bottling excludes the air, bacterial activity becomes arrested while the yeast continues to work. Tea cider seldom contains over 1 per cent. alcohol, but spirit may be added. The beverage is easily and cheaply brewed at home.

An excellent vinegar can also be made from a sweetened tea infusion, the procedure being the same as in the preparation of tea cider, except that the brew is left in the open vessel for about a month. The vinegar is then strained, boiled, and bottled.

Acetic acid prepared in this way may perhaps be useful for coagulating latex in the preparation of rubber.

[This paper also appears in a slightly expanded form in *Tea Quarterly*, vi, 1, pp. 48–53, 1933.]

JOCHEMS (S. C. J.). **Verslag van het Deli Proefstation over het jaar 1932.** [Report of the Deli Experiment Station for the year 1932.]—*Meded. Deli Proefstat. te Medan-Sumatra*, Ser. II, lxxxiv, 74 pp., 1933.

Some further notes are given on the diseases of tobacco observed or investigated at Deli, Sumatra, in 1932 [*R.A.M.*, xii, p. 470].

VAN BEYMA THOE KINGMA (F. H.). **On some moulds of the genus Monilia isolated from Tobacco.**—*Zentralbl. für Bakt.*, Ab. 2, lxxxviii, 5–7, pp. 124–131, 10 figs., 1933.

From Mr. Jollyman, Chemical Laboratory of the Imperial Tobacco Company, Bristol, and Mr. Bunting, Stored Products Research Laboratory, the 'Centraalbureau voor Schimmelcultures', Baarn, Holland, received some cultures of moulds isolated from half or wholly manufactured tobacco leaves. The following were determined by the author as new species: *Monilia cerebriforme*, *M. macrospora*, and *M. microspora*, while for one of the fungi received from Bristol a new combination was made, namely, *M. medoacensis* (Sacc.) van Beyma (*Oospora medoacensis*), which is distinguished from the other species examined by its extraordinarily slow growth. On standard media all these species form budding, hyaline to light-coloured conidia, and at a later stage, articulated, branched hyphae, sometimes producing a tomentose growth. In older cultures thick-walled conidia (sometimes brown) are formed. They are considered to agree with the description of the genus *Monilia* in Engler and Prantl's *Pflanzenfamilien*, i, 1**, p. 424, 1900.

APPEL (O.). **Tomatenkrankheiten** [Tomato diseases.]—*Deutsche Landw. Presse*, lx, 20, p. 247, 1 col. pl., 1933.

Popular notes are given on the occurrence and control in Germany of the tomato diseases caused by *Phytophthora infestans* [*R.A.M.*, xii, p. 549]; *Fusarium acuminatum* [ibid., ix, p. 37], the agent of a rot commencing at the extreme apex and gradually extending over the whole fruit, producing complete mummification; other fruit rots caused by *Phoma destructiva*, *Macrosporium* [*Alternaria*] *tomato* [ibid., xii, p. 121], and *Botrytis cinerea*; bacterial wilt [*Aplanobacter michiganense*]; and stem rot [*Didymella lycopersici*: see next abstract].

BREMER (H.). **Tomaten-Stengelfäule und bakterielle Tomatenwelke.** [Tomato stem rot and bacterial wilt of Tomatoes.]—*Obst- und Gemüsebau*, lxxix, 4, p. 59, 1933.

The stem rot of tomatoes caused by *Didymella lycopersici* [*R.A.M.*, xii, pp. 477, 549] is briefly differentiated from the bacterial wilt due to *Aplanobacter michiganense*. [In a note on p. 58

of the journal it is stated that these are the officially approved popular names for the two diseases, both of which are often erroneously termed 'canker' in Germany.] The former usually appears as a sudden withering of the entire plant, the immediate cause of which is the black rot of the stem base, while the latter is characterized by a more gradual wilting associated with a yellow discoloration and disintegration of the vascular bundles within the stem. Both diseases are transmissible by the seed and pass from plant to plant through human agency, wind, rain, and possibly through the use of infected sticks [see next abstract]. Control measures are indicated, including the immersion of the roots at transplanting in a weak fungicidal solution, e.g., 0·25 per cent. uspulun.

KORDES [H.]. **Tomatenpfähle und Tomatenstengelfäule.** [Tomato sticks and Tomato stem rot.]—*Obst- und Gemüsebau*, lxxix, 4, p. 58, 1933.

During 1932 the writer observed that the sticks up which tomato plants are trained constitute an important source of infection by *Didymella lycopersici* [see preceding abstract]. The spores disseminated in the autumn overwinter in the cracks of the sticks, whence they readily pass to the young plants in the spring. The sticks should be disinfected in 5 per cent. formalin (at least half-an-hour's immersion) and left covered with sacking or the like for two or three days before use.

HOFFMAN (I. C.). **Potash starvation in the greenhouse.**—*Better Crops with Plant Food*, xviii, 6, p. 10, 4 figs., 1933. [German abs. in *Ernährung der Pflanze*, xxix, 13, pp. 256–257, 1933.]

Tomato and cucumber plants in Ohio glasshouses were found to suffer from potash deficiency, resulting in discoloration of the leaves from the base upwards, crinkling of the interveinal areas (where an excess of nitrogen was given), necrotic spotting and brittleness of the foliage, thin, spindling stems and tendrils, and (in the case of tomato) brown stripes on the stems, petioles, and main leaf veins. The fruits of affected tomato and cucumber plants were irregular in shape, those of the former being also poorly coloured. Recommendations for potash manuring are given.

TUBEUF [C. v.]. **Studien über Symbiose und Disposition für Parasitenbefall sowie über Vererbung pathologischer Eigenschaften unserer Holzpflanzen. I. Das Problem der Hexenbesen.** [Studies on symbiosis and tendency to parasitic infection and on the inheritance of pathological characters in our woody plants. I. The problem of witches' brooms.]—*Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz*, xliii, 5, pp. 193–242, 60 figs., 1933.

The author considers that the witches' brooms of woody plants (some 60 of which are illustrated from photographs) may be regarded as dense, upward-growing branch systems parasitizing the normally branched host in the same way as mistletoe or *Loranthus* bushes.

Witches' brooms may be classified in the following groups [cf. *R.A.M.*, vi, p. 706]. A. Symbiotic witches' brooms caused by parasites: I. By parasitic plants, (1) higher plants, represented by *Arceuthobium* spp., and (2) lower plants (fungi belonging to the Exoascaceae, Uredinales, and Ustilaginales). II. By parasitic insects (or mites). B. Witches' brooms developing without parasitic stimulus, a marked feature of which, in addition to the absence of pathogenic organisms, is the transmissibility of shape and slowness of growth to the progeny. In the witches' brooms of this type studied by the author from 1907 onwards, chiefly on *Picea excelsa*, a certain percentage of the progeny of affected trees form the brooms and remain dwarfed. It is probable that the majority of the dwarfed forms reported in the literature arise in this manner.

A striking instance of adaptation to the symbiotic mode of life is afforded by the witches' broom caused by *Caeoma deformans* on *Thujopsis dolabrata* [ibid., vi, p. 233]. The fungus produces a subspherical structure composed of leafless, profusely ramified shoots with a brown bark, attaining the size of a head. In this case the entire witches' broom is at the service of the parasite, to which it transfers the nourishment supplied to it by the host. A somewhat similar condition occurred in an antler-shaped witches' broom recorded by the writer (*Naturw. Zeitschr. für Forst- und Landw.*, p. 401, 1913) on *Laurus nobilis*, the causal organism being *Exobasidium lauri*. This formation resembled the gall described on *Aspidium aristatum* as caused by *Taphrina cornu-cervi*.

Witches' broom parenchyma is full of starch, so that assimilatory chlorophyll must be present, at any rate in the subtending leaf; differentiated epidermal cells and stomata are, however, not formed.

GUINIER (P.). **Sur la biologie de deux champignons lignicoles (Stereum purpureum Pers. et S. hirsutum (Wild.) Pers.).** [On the biology of two lignicolous fungi (*Stereum purpureum* Pers. and *S. hirsutum* (Wild.) Pers.).]—*Comptes rendus Soc. de Biol.*, cxii, 13, pp. 1363–1366, 1933.

*Stereum purpureum* is commonly found on felled beech, birch (*Betula alba*), poplar, hornbeam (*Carpinus betulus*), and other wood, while *S. hirsutum* occurs mainly on oaks (*Quercus pedunculata* and *Q. sessiliflora*). However, in a forest near Autun, Saône-et-Loire, *S. hirsutum* was observed in 1931 on beeches from which the bark had fallen in consequence of a fire two years previously, while *S. purpureum* was absent. The latter fungus can only invade wood of which the living cells (woody parenchyma and medullary rays) are still intact and contain reserve materials; hence its localization in the young, peripheral layers and cessation of growth after about a year when the reserves in this region are exhausted. The inability of *S. purpureum* to infect oaks may be attributed to the tannin content in these trees [cf. *R.A.M.*, viii, p. 261]. *S. hirsutum*, on the other hand, can attack the wood in the absence of all living matter and feed on the membranes for a number of years, causing serious decay of the sapwood [ibid., xi, p. 343]. In competition with the more rapidly growing *S. purpureum*, *S. hirsutum* is liable to be suppressed, but it develops

under conditions adverse to the activity of the former, e.g., on wood that has been felled for some time and on dead branches.

BUISMAN (CHRISTINE). **Verslag van de onderzoekingen over de Iepenziekte, verricht in het Phytopathologisch Laboratorium Willie Commelin Scholten te Baarn, gedurende 1932.** [Report of the investigations on the Elm disease conducted in the Phytopathological Laboratory 'Willie Commelin Scholten' at Baarn during 1932.]—*Tijdschr. over Plantenziekten*, xxxix, 4, pp. 77–94; 5, pp. 101–113, 1 pl., 1933.

Further experiments [the results of which are fully tabulated and discussed] on the reaction to *Ceratostomella ulmi* of a large number of European, Asiatic, and American elm species and varieties [*R.A.M.*, xii, p. 541] showed that the most promising in the first group are *Ulmus foliacea* with its varieties *dampieri* and *wredei*, *U. glabra* and its var. *fastigiata*, *U. hollandica* [var.] *vegeta*, *U. procera* [var.] *monumentalis* Rinz, and *U. procera* [var.] *berardi*. The American species proved so highly susceptible that further tests on this group appear superfluous. Some degree of resistance was shown by the following Asiatic forms: *U.* sp. from Karagatch, *U. laciniata* [var.] *nikkoense*, *U. parvifolia* (comprising *U. sieboldii* and *U. shirasawana* according to Rehder's system of classification), *U. wilsoniana*, and *U. pumila* and its var. *pinnato-ramosa*.

Inoculation experiments with *C. ulmi* on ash, *Robinia pseud-acacia*, and *Celtis occidentalis* gave negative results. The fungus was reisolated from branches of beech, alder, oak, *C. orientalis*, and lime [*Tilia*] at points ranging from immediately above the site of inoculation (alder) to 35 cm. above it (lime). *Verticillium albo-atrum* was isolated from a number of trees and shrubs exhibiting symptoms suggestive of die-back at Baarn in 1932, including ash and *Robinia pseud-acacia* [ibid., xi, p. 275], while *C. ulmi* was isolated only from a diseased *Zelkova serrata* [ibid., xi, p. 484].

The inability of *C. ulmi* to penetrate unwounded elm roots was shown by a test in which seedlings of *U. glabra* were repeatedly watered with a spore suspension of the fungus without result, whereas those inoculated through the roots by injection with a syringe developed the typical discoloration of the wood.

Perithecia of *C. ulmi* developed on the bark of three out of five diseased elms at De Bilt, but were found on only one out of four felled trees at the Hague. It is considered that their formation is not a regular feature in the life-history in nature.

Inoculation experiments were carried out with *C. quercus* from oak [ibid., vii, p. 286] on *U. americana* and oak, *C. fagi* from beech on *U. americana* and beech, and *C. pluriannulata* + and − [ibid., ix, p. 76], found by Mrs. Gregor on an elm killed by die-back, on *U. americana*. Discoloration of the wood developed only on two branches inoculated with *C. pluriannulata*, but isolations from this material yielded *V. albo-atrum*. *C. quercus* was reisolated from inoculated elm and oak branches and *C. fagi* from those of elm and beech, but only near the point of infection and there is so far no evidence that they are able to cause disease.

ALEXANDRI (A. V.). **Uscarea Ulmilor în România.** [The Elm disease in Rumania.]—Reprinted (1933) from *Bul. Soc. Stud. Ştiinţe Nat.*, Bucharest, iii, 16 pp., 7 figs., 1932. [French summary.]

In giving a brief survey of the literature dealing with the etiology and morphology of the Dutch elm disease (*Ceratostomella ulmi*) [see preceding abstract] the author states that since its first discovery in Rumania in 1929 it has spread practically over the whole of the country, where it attacks the two indigenous species *Ulmus campestris* and *U. montana*, and the imported *U. americana* which is planted along the streets and roads. Owing to the difficulties presented by control measures he recommends the replacement of the diseased elms by resistant or immune trees. The paper also includes a list of other fungal diseases of the elm, including the leaf and twig parasite *Sphaeropsis nervisequa* described from Germany by Lang (*Ber. Deutsch. Dendrol. Ges.*, xxxv, 1, p. 37, 1917) which the author suggests renaming *Haplosporella nervisequa* comb. nov., since according to Petrak and Sydow [*R.A.M.*, v, p. 331] all the species of *Sphaeropsis* with one-celled, oval or elliptical spores, devoid of a gelatinous envelope, such as occur in this fungus, should be referred to the genus *Haplosporella*.

HÅRD AV SEGERSTAD (F.). **Till frågan om värdväxterna för Uncinula adunca (Fr.) Lév.** [On the question of the host plants of *Uncinula adunca* (Fr.) Lév.]—*Svensk Bot. Tidskr.*, xxvi, 3–4, pp. 464–465, 1932.

Willows (*Salix caprea*) in Dalsland, Sweden, were observed by the writer in the late summer of 1932 to be heavily parasitized by *Uncinula adunca* (Fr.) Lév. (= *U. salicis* (DC.) Wint.) [*R.A.M.*, v, p. 15; ix, pp. 408, 568]. A list is given of the hosts of this mildew known in Scandinavia.

KRAVTZEFF (B. I.). Грибные болезни Сибирской Пихты. [Diseases of the Siberian Pitch Fir.]—Pamphlet issued by *Омское Бюро Общ. Краеведения* [*Omsk Bureau Soc. Regional Knowledge*], Omsk, 30 pp., 11 figs. (one on title-page), 1 map, 1933.

Among the 115 species of parasitic and saprophytic fungi listed in this paper as having been so far recorded on the Siberian pitch fir (*Abies sibirica*), those responsible for bole and heart rots are discussed most fully owing to their widespread nature and to the considerable financial losses they cause in many localities of Siberia, frequently resulting in the rejection of over 50 per cent. of the logs felled for constructional purposes or as mine props. These include *Fomes robustus* f. *pinuum* which is stated to be frequent in Siberia only on *A. sibirica* and to be found chiefly on trees attacked by other fungi, especially the rust *Melampsorella cerastii* which is widespread and causes witches' brooms and canker lesions on the fir: in the Russian Far East *F. robustus* f. *pinuum* is however frequently found also on *Picea ajanensis*. In the north of Siberia young pitch firs suffer severely from attacks of the rust *Calyptospora goeppertiana* [*R.A.M.*, ix, p. 420].

LIESE (J.). **Brunchorstia destruens Eriks., Erreger des Triebsterbens der Kiefer.** [*Brunchorstia destruens* Eriks., the agent of the die-back of Pine shoots.]—*Forstarchiv, 1933*, 10, pp. 170–171, 2 figs., 1933.

Recent studies on *Brunchorstia destruens*, the causal organism of the die-back of pine shoots in Germany, show that this fungus is not genetically connected with *Cenangium abietis* as previously supposed [*R.A.M.*, x, p. 699]. For four years the olive-green mycelium derived in pure culture from the pycnidia of *B. destruens* from diseased pine branches have failed to produce apothecia, and conversely, the apothecia of *C. abietis* give rise to a white mycelium with different characters from that of *B. destruens.* [Jørgensen has shown [ibid., x, p. 272] that the perfect stage of *B. destruens* is *Crumenula abietina.*]

WEESE (J.). **Über den Nadelschüttepilz von Pinus strobus.** [On the fungus causing leaf fall of *Pinus strobus.*]—*Mitt. Bot. Inst. Tech. Hochschule Wien*, ix, 1, pp. 22–24, 1932. [Received July, 1933.]

The author states that when investigating the cause of leaf fall of *Pinus strobus* in Silesia in 1929 he compared Tubeuf's authentic material of *Hypoderma brachysporum* (Rostr.) Tub. (1902) with the original sample of *H. desmazierii* Duby (1861), with the conclusion that both are identical. The fungus should, therefore, be known under the latter name, with *Lophodermium brachysporum* Rostrup 1883, *H. brachysporum*, and *H. strobicola* Tubeuf 1897 as synonyms [cf. above, p. 604].

*H. lineare* Peck, which also occurs on the needles of *P. strobus*, is distinct from *H. desmazierii* and, according to von Höhnel, should be referred to the genus *Bifusella.*

LAGERBERG (T.). **Ascochyta parasitica (Hartig), en skadesvamp på Granplantor.** [*Ascochyta parasitica* (Hartig), a parasitic fungus on Spruce plants.]—*Svenska Skogsvårdsfören. Tidskr.*, xxx, 1, pp. 1–10, 3 figs., 1933. [English summary.]

One-year-old spruce (*Picea excelsa*) seedlings at the State Institute of Experimental Forestry, Stockholm, were extensively attacked in the autumn of 1930 by *Ascochyta parasitica* (*A. piniperda*), not hitherto observed in Sweden.

Infection takes place on the current year's shoots, the basal parts of which turn brown while the upper portions, though temporarily remaining green, lose their turgescence and droop. Ultimately the mycelium permeates and kills the shoots. In one-year-old seedlings the needles of affected shoots do not drop prematurely, as in older trees, and the pycnidia of the fungus therefore develop on them. The writer's observations on the morphology of *A. piniperda* agree in the main with those of Hartig, except that the conidiophores are branched. The severe damage reported to be caused by the fungus in Germany is not considered to be proved, and some other agent is thought to have been involved.

PIERSON (ROYALE K.). **Fusion of pycniospores with filamentous hyphae in the pycnium of the White Pine blister rust.**—*Nature*, cxxxi, 3316, pp. 728–729, 1933.

From the crust-like stromatic layer characteristic of the subcortical pycnidia of the white pine blister rust [*Cronartium ribicola*] arise slender, erect pycnidiophores, closely compacted in a palisade arrangement and accompanied by an occasional filamentous hypha projecting some way above the common level reached by the pycnidiophores. The structure of the hypha is similar to that of the pycnidiophores, but it usually exceeds the latter in diameter and is more irregular in outline. No cross walls have been observed in these hyphae, which usually contain a single nucleus near the base. The tips of such hyphae are often bent over into a procumbent position due to the pressure of the overlying host cells. The occurrence of this type of hypha was first reported by R. H. Colley (*Journ. Agric. Res.*, xv, p. 619, 1918).

A cytological study was made at the Idaho School of Forestry of stained and fixed pycnidia of *C. ribicola*, fertilized by the interchange of pycnospores, and of an equal number of unfertilized pycnidia of similar age. Eleven cases of fusion between pycnospores and the above-mentioned filamentous hyphae were observed, whereas no instance of such a process was detected in the sterile material. The pycnospores were united to the ends of the hyphae by short tubes, longer and somewhat narrower than those figured by Craigie for sunflower rust [*Puccinia helianthi*: *R.A.M.*, xii, p. 318]. A few of the pycnospores were apparently empty, while others contained nuclei in the usual site. Actual migration of nuclei was not observed.

CHAPMAN (A. D.) & SCHEFFER (T. C.). **New chemical treatments for the control of sap stain and mold in Southern Pine and hardwood lumber.**—Reprinted from *The Southern Lumberman*, 4 pp., 1 fig., 15th May, 1933.

A tabulated account is given of the writers' continued tests in Louisiana in 1932 on the control of sap stain [*Ceratostomella* spp.] on southern pine [*Pinus palustris*] and hardwoods, including sap gum [*Liquidambar styraciflua*], yellow poplar [*Liriodendron tulipifera*], oak, beech, and black gum [*Nyssa sylvatica*: *R.A.M.*, xi, p. 816; xii, p. 411].

The best results in commercial scale tests were given by lignasan (0·25 per cent.) and sodium tetrachlorophenolate (0·3 per cent.), which reduced the incidence of stain to under 1 per cent. LE–3 (an ethyl mercury oleate preparation, 0·24 per cent.) and a mixture of sodium tetrachlorophenolate and sodium 2-chloroorthophenylphenolate (0·3 per cent. of each) ranked next in general efficacy, while the latter compound (known as SCOPP) alone gave satisfactory results with all the woods except *L. styraciflua*. In the case of pine SCOPP, either alone or mixed with sodium tetrachlorophenolate (STCP), was definitely superior in the control of stains and mould to lignasan, LE–3, or STCP alone. In withstanding washing out SCOPP was better than LE–3 or lignasan in pine, while STCP was the best for sap gum.

Used at the rate of 1·5 or 3 per cent. as a spray for pine export timbers, SCOPP gave very satisfactory results against stain and mould, 90 per cent. of the treated pieces reaching London in good condition. In another test on partially seasoned pine dipped in lignasan (0·37 per cent.) at the mill but not re-treated on loading, there was about 25 per cent. stain on arrival at Havana after 11 days in transit, the corresponding figure for LE—3 (0·5 per cent. on loading) being 10 per cent.

The corrosive action of the chemical compounds on the equipment may be obviated by the addition of alkali to the solution, which likewise prevents the iron tannate discoloration that is liable to develop in treated oak timber.

**Dry rot in wood.**—*Dept. of Sci. and Indus. Res., Forest Products Res. Bull.* 1 (2nd Edit.), 34 pp., 9 pl., 2 diags., 1933.

In the first part of this bulletin (written by K. St. G. Cartwright and W. P. K. Findlay) *Fomes cryptarum*, *Lentinus lepideus*, and *Stereum frustulosum* are added to the list given in the original edition [*R.A.M.*, viii, p. 79] of the fungi that cause dry rot of constructional timbers in England, and brief notes are given on the nature of the decay caused by them. The second section, contributed by H.M. Office of Works, London, deals with the detection and practical treatment of dry rot, and in the third, contributed by the Building Research Station of the Department, the precautions are discussed, which are to be taken to prevent outbreaks of dry rot in new buildings.

HEDGCOCK (G. G.). **The prevention of wood-staining in basket veneers.**—*Journ. of Forestry*, xxxi, 4, pp. 416–420, 1933.

A tabulated account is given of the writer's laboratory and factory experiments on the efficacy of a number of chemicals against the staining of hardwood veneer baskets by fungi, including *Ceratostomella pluriannulata* [see above, p. 665], *Ceratostoma rugosa* Hedgc. n. sp. pro tem. [no diagnosis], *Cladosporium*, *Graphium*, *Hormodendron*, and *Hormiscium* spp., besides various moulds forming unsightly blotches on the surface of the wood.

Freshly cut staves from stain-free logs were used in all the tests, the results of which showed that the following were the most effective treatments in the factory: 3 per cent. each of borax and boric acid and 8·5 per cent. sodium carbonate; 10 per cent. lime and 10 per cent. sulphur; 0·1 per cent. mercuric chloride and 0·2 per cent. hydrochloric acid; 10 per cent. potassic alum; 0·3 per cent. phenyl salicylate (salol); 10 per cent. sodium bicarbonate; and 10 per cent. sodium carbonate. Of these compounds the lime and sulphur mixture is the cheapest.

STIMSON (E.). **Does it pay to treat timber?**—*Railway Engin. & Maintenance*, xxix, 4, pp. 184–186, 189, 1 fig., 1933.

Various instances are cited of the early preservative treatment of bridge timber in the United States from 1875 onwards [cf. *R.A.M.*, xii, p. 70], including the Lake Pontchartrain trestle bridge, finished in 1883, a recent inspection of which showed that some 50

per cent. of the original creosoted yellow pine [*Pinus palustris*] timber is still in use. The writer's own experience on the Baltimore and Ohio Railway dates back to 1910, when a ballast-deck pile trestle was treated with creosote by the Lowry process, the red oak [*Quercus rubra*] piling with an average retention of 10·6 lb. per cu. ft., and the yellow pine remaining portions at 9·2 lb. So far there has been no outlay on repairs.

In 1913 the Baltimore and Ohio Railway started treating sleepers by the Card process [ibid., xi, p. 815], using a mixture of ½ lb. dry zinc chloride and 3 lb. water-gas tar per cu. ft.; in 1927 this method was superseded by a creosote-petroleum mixture and the Rueping process [loc. cit.] from which at least 20 years' service is anticipated. In 1900, only 2,800,000 sleepers, or 3·2 per cent. of the 85,000,000 used were treated. By 1910 the number had increased to 30,544,000 or 20·6 per cent. of the total of 148,231,000. In 1920, 43·5 per cent. of the sleepers were treated, and in 1930, 78·5 per cent., nearly all with creosote.

Records of the renewals on 27 of the principal American railways show that in 1911 they were 262 sleepers per mile, while by 1931 this figure had fallen to 117, a reduction of 145 sleepers per mile or 29,071,340 for all the 27 railways, with an estimated cash saving of $26,635,337.

RATH (L.). **Erfahrungen bei der Bekämpfung der Kohlhernie.** [Observations in the control of finger-and-toe disease of Cabbage.]—*Obst- und Gemüsebau*, lxxix, 4, p. 63, 1933.

Treated seed of the red cabbage variety Später holländischer [Late Dutch] Export, the white Brunswick, and the Westländer Brussels sprouts was sown in a field under uniform conditions. The first-named variety remained almost completely free from finger-and-toe disease [*Plasmodiophora brassicae*], which was very severe, however, on both the other sorts [cf. above, p. 608].

TEDIN (O.). **Nedärvningen av resistens mot klumprotsjuka (Plasmodiophora brassicae) hos Rova (Brassica rapa v. rapifera) i förhållande till vissa morfologiska rotkaraktärer.** [The inheritance of resistance to finger-and-toe disease (*Plasmodiophora brassicae*) in Turnips (*Brassica rapa* v. *rapifera*) in relation to certain morphological root characters.]—*Nordisk Jordbruksforskning*, xiv, pp. 324–331, 1932. [Abs. in *Plant Breeding Abstracts*, Imperial Bureau of Plant Genetics, iii, 4, pp. 192–193, 1933.]

A Danish turnip, Marienlyst V, resistant to finger-and-toe disease (*Plasmodiophora brassicae*), was crossed in Sweden with two susceptible Swedish strains, Weibull's Pedigree Bortfelder and Rodtoppiga [red-topped] Bortfelder, the latter not yet on the market [*R.A.M.*, iv, p. 389]. The resistant variety is characterized by short, flat roots in contrast to the long ones of the susceptible strains, and this character was reproduced among the progeny of the crosses in such a way as to suggest a linkage between the factors determining shape and those involved in resistance.

HORSFALL (J. G.) & KERTESZ (Z. I.). **Abnormal enlargement of Peas from plants affected with root-rot.**—*New York (Geneva) Agric. Exper. Stat. Bull.* 621, 20 pp., 6 graphs, 1933.

The results of the investigation reported in this paper, which was conducted in 1931 and 1932, established the fact that peas produced on plants affected with root rot (involving a number of organisms, among which *Rhizoctonia* [*Corticium*] *solani* appeared to be very largely responsible for the disease in 1931, while *Pythium* spp. were probably the most important in 1932) developed to larger dimensions as determined both by sieve-passing capacity and volume per pea than those on healthy plants, under normal soil moisture conditions; in drier soils the peas on root-diseased plants shrivelled prematurely and remained smaller than normal. There was clear evidence that the larger size of the diseased peas was due to a more rapid rate of growth rather than to any difference in the blossoming date of the diseased and healthy plants.

LAURITZEN (J. I.), HARTER (L. L.), & WHITNEY (W. A.). **Environmental factors in relation to Snap-Bean diseases occurring in shipment.**—*Phytopath.*, xxiii, 5, pp. 411–445, 4 graphs, 1933.

A fully detailed and tabulated account is given of the writers' investigations at the Arlington Experiment Farm, Virginia, on the factors affecting various transit diseases of beans (*Phaseolus vulgaris*) [*R.A.M.*, xii, p. 71].

The following pathogens were used: *Colletotrichum lindemuthianum* from beans, *Bacterium phaseoli* from beans and Lima beans [*P. lunatus*], *Sclerotinia sclerotiorum*, *Pythium butleri* [ibid., xi, p. 218], *Rhizopus tritici* [ibid., vii, p. 2], and *R. nigricans* from sweet potato [ibid., x, p. 269], *Rhizoctonia* [*Corticium*] *solani* and *Sclerotium rolfsii* from beans, and *Botrytis cinerea* from pepper [*Capsicum annuum*].

The beans (chiefly Bountiful from Florida) were stored either in ventilated insulated or galvanized iron chambers with controlled temperature and humidity.

*C. lindemuthianum* can infect beans at temperatures from about 7° to 33° C., the optimum being from 22° to 25° at which and at 27° the incubation period is 5 days, compared with 7 at 15·5° and 17·5°, 9 at 12°, 12 at 10°, and 14 at 7°.

Infection by *Bact. phaseoli* was obtained only through needle pricks at a temperature range of 2° to 31°. The development of blight lesions was observed in apparently healthy beans from diseased stocks at a range of 1·2° to 35°. *S. sclerotiorum* caused infection between 0° and 28°, the optimum lying between 19° and 24°. The earliest infection at 12° was observed in 4 days and at 0° in 15. *P. butleri* was infective between 12° and 35·6°, the optimum being about 31°. Infection by *C. solani* took place at a range of 0·9° to 35·5°, with an optimum at 24° to 32°; the incubation periods were 20 days at 0·9° and 2° and 16 at 5·5° and 8°. *S. rolfsii* infected beans at 8° to 35·6°; at the former degree and 12°, however, only after 11 days' storage. Infection by *R. tritici* and *R. nigricans* was found on beans exposed to temperatures above 30°; below 12° the infection is usually very slight. Infec-

tion by *B. cinerea* occurred between 0° and 35·5°, the incubation periods being 4 days at 12° to 35·5°, 6 at 6° and 8°, and 15 at 0°.

Deterioration of beans, apart from that due to micro-organisms, is very rapid at temperatures above 20°, especially at 35·5°. In bean consignments sent from Florida to Washington, the quality remained good for 4 to 15 days at 6° to 7° and for 6 to 15 at below 6°. Taking into consideration both the quality of the beans and the diseases likely to occur in transit, shipment at temperatures below 10° is recommended.

LINK (K. P.) & WALKER (J. C.). **The isolation of catechol from pigmented Onion scales and its significance in relation to disease resistance in Onions.**—*Journ. Biol. Chem.*, c, 2, pp. 379–383, 1933.

From the outer scales of pigmented Californian onions the writers isolated catechol (3, 4-dihydroxybenzene), a substance that is absent from the same parts of the white varieties [*R.A.M.*, xi, p. 561]. Catechol was found to be somewhat more toxic than protocatechuic acid [ibid., x, p. 701] to the causal organism of smudge (*Colletotrichum circinans*), as demonstrated by the addition of varying amounts of each to a modified Czapek's solution. Thus, the growth of the fungus was inhibited by 1 part of the acid to 800 of the medium, while 1 of catechol to 1,600 sufficed to produce the same result. When spores of *C. circinans* were placed in a solution of 1 part of protocatechuic acid to 1,600 of water, abnormal germination occurred, while in the case of catechol no growth took place at 1 in 1,600 and retardation was observed at 1 in 3,200.

**Legislative and administrative measures. Portugal.**—*Internat. Bull. of Plant Protect.*, vii, 5, pp. 109–110, 1933.

Under Presidential Decree No. 22:389 of 29th March, 1933, seeds, plants, and parts thereof imported into Portugal must be accompanied by official certificates of origin vouching for the freedom of the consignments from potato wart (*Synchytrium endobioticum*), which must further be absent from the area within a 5 km. radius of the place of cultivation [*R.A.M.*, xi, p. 272; xii, p. 127]; for the absence from the region of origin of *Bacillus amylovorus* [on Rosaceae], *Endothia parasitica* [on chestnut], and court-noué [on vine]; and for the freedom of any plant within a radius of 5 km. from the place of cultivation from attack by *Phytophthora cambivora*. Some small centres of potato wart having been detected in the north of Portugal, the usual measures have been prescribed by Presidential Decree No. 22:463 of 8th April, 1933, to eradicate the disease.

**Legislative and administrative measures. Latvia.**—*Internat. Bull. of Plant Protect.*, vii, 5, p. 109, 1933.

A Decree of the Minister of Agriculture, dated 2nd December, 1932, provides for the destruction of barberry (*Berberis vulgaris*) [against *Puccinia graminis*] and of buckthorn (*Rhamnus cathartica*) [against *P. lolii*], originally ordered by the Law of 20th March, 1930, to be completed by 20th March, 1935.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW

OF

# APPLIED MYCOLOGY

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COOK (H. T.). **The control of powdery mildew of snap Beans.**—Reprinted from *Trans. Peninsula Hort. Soc.*, xxii, 5, 4 pp., 1932. [Received July, 1933.]

Of 11 fungicides tested in 1931 at the Virginia Truck Experiment Station for their efficacy against powdery mildew [*Erysiphe polygoni*] of snap beans [*Phaseolus vulgaris*: *R.A.M.*, xi, p. 346], kolofog [ibid., xi, p. 788], kolodust [ibid., xi, p. 385], lime-sulphur dust, and dry lime-sulphur spray gave the most satisfactory results. For practical purposes the last-named should prove generally effective if applied three or four times, beginning soon after the first appearance of the disease.

HOGGAN (ISMÉ A.). **Some viruses affecting Spinach, and certain aspects of insect transmission.**—*Phytopath.*, xxiii, 5, pp. 446–474, 5 figs., 1933.

The writer's investigations [a comprehensive, tabulated account of which is given] in Wisconsin have shown that spinach is susceptible to at least three different virus diseases, namely, those caused by the cucumber mosaic, sugar beet mosaic, and tobacco ring spot viruses [*R.A.M.*, x, p. 574; xii, pp. 473, 539]. All three diseases are characterized by conspicuous yellowing and necrosis of the foliage, while the two first-named frequently cause the death of the whole plant.

Cucumber (Select White Spine) mosaic was found to be transmissible to sugar beet, local lesions resulting from inoculation by needle pricks and rubbing, as well as by the aphids, *Myzus persicae* and *Macrosiphum solanifolii* [*M. gei*] when these were confined to single leaves. Systemic infection, on the other hand, developed when the insects were allowed to wander freely over the plants. Cucumber mosaic was further shown to be transmissible to Bloomsdale spinach both by aphids and by artificial inoculation, the symptom sequence on this host closely resembling that of spinach blight, as originally described by McClintock & Smith (*Journ. Agric. Res.*, xiv, p. 1, 1918). The Virginia Savoy variety, known to be resistant to the latter disorder, shows definite indications of resistance to cucumber mosaic under greenhouse conditions. Moreover, spinach plants from Long Island, reported to be naturally infected by blight, were found to harbour the cucumber mosaic virus (cucumber virus 1) [*R.A.M.*, x, p. 60; xi, p. 349].

Sugar beet mosaic was readily transmitted to spinach by aphids and by artificial inoculation, no indication of resistance being given by the Virginia Savoy variety. The symptoms of this disease on spinach differ in several respects from those of blight, though closely resembling a spinach mosaic described from Germany [ibid., ix, p. 428]. The longevity *in vitro* of the sugar beet mosaic virus was 24 to 48 hours at 70° F., the tolerance to dilution 1 in 1,000, and the thermal death point for a ten-minute exposure 55° to 60° C.

Tobacco ring spot proved to be readily communicable to both spinach varieties by artificial inoculation, but not by aphids. The infected plants developed large, chlorotic areas with a marked tendency to necrosis but no malformation of the leaves, while recovery frequently took place, especially in warm weather. These symptoms bear no marked resemblance to those of spinach blight.

No indication was obtained of direct transmission of the cucumber mosaic virus from infective aphids (*M. gei*) to their progeny.

RIBEREAU-GAYON [J.]. **Sur le mécanisme de l'action des composés cupriques contre le mildiou.** [On the mechanism of the action of copper compounds against mildew.]—*Comptes rendus Acad. d'Agric. de France*, xix, 16, pp. 550–555, 1933.

The writer propounds the following theory, based on his experiments with yeasts in which he found that they can absorb and fix almost the whole of the copper present in dilute solutions, to explain the toxicity of copper compounds towards vine mildew [*Plasmopara viticola*: *R.A.M.*, xi, p. 663].

When a zoospore is placed in a sufficiently strong copper solution its development is impeded by rapid absorption and fixation in the cell of the large number of copper ions in its vicinity. In a very dilute solution the zoospore fixes the few ions around it, but these do not suffice to prevent its germination before the diffusion of the remoter ions re-establishes the balance of the concentration. If, however, a particle of a copper compound, even a practically insoluble one, comes into direct contact with the zoospore, it dissolves proportionately with the fixation of the copper ions by the latter, a process facilitated by the cell secretions. The copper is conveyed in minute quantities from the copper particle to the zoospore, where it accumulates with a lethal effect. In this way an impression of contact action is produced by what is in reality a process of dissolution.

Assuming that this hypothesis is correct, the toxicity of a copper compound towards vine mildew is necessarily dependent on dissolution, in which, however, rapid solubility is not the primary factor. Among the most important factors in the efficacy of a copper fungicide are the concentration of copper ions, the presence of non-ionized copper in various forms, the hydrogen-ion concentration, and the presence of calcium salts, of an acid, or of a substance of the nature of carbon dioxide, any of which may assist in the dissolution of copper compounds, though some of these may simultaneously reduce copper fixation by the zoospores, so that

their inclusion is not necessarily advantageous. The exact *dosis toxica* for an anti-mildew copper fungicide can thus hardly be defined. Furthermore, a fungicidal action may be exerted not only by copper oxide, but also, following the same mechanism, by basic oxides or basic dyes, acting as positively charged metallic ions [cf. ibid., xi, p. 663].

[This paper is reprinted in *Rev. de Vitic.*, lxxviii, 2032, pp. 362–364, 1933.]

FRAPPA (C.). **Sur la présence de l'anthracnose de la Vigne dans certains vignobles du centre de Madagascar.** [On the presence of anthracnose of the Vine in certain vineyards in the central region of Madagascar.]—*Bull. Écon. Mens.*, Madagascar, N.S., 77, pp. 51–52, 1933.

Attention is drawn to the detection in November, 1932, in the Antananarivo and Miarinarivo districts of Madagascar, of anthracnose of the vine (*Gloeosporium ampelophagum*), a brief, popular note on the symptoms and control of which is given.

RAVAZ (L.), DUPONT (E.), & CALLAUDAUX (R.). **Recherches sur le rougeau de la Vigne.** [Researches on rougeau of the Vine.] —*Ann. Agron.*, N.S., iii, 2, pp. 225–231, 1933.

The non-parasitic rougeau disease of the vine (known as flavescence on the white and grey grape varieties) [*R.A.M.*, xii, p. 487] affects *Vitis vinifera* but not American vines, while very few non-grafted hybrids are affected, nearly all those which are susceptible (Alicante-Ganzin, 4646 S, 142 E.M., etc.), being derived from crosses with dark varieties which give colour to the wine, such as Teinturier du Cher, Petit Bouschet, and Alicante Bouschet.

After heavy rain from 8th to 11th September, 1931, rougeau was general in France, though later on the abnormal colouring tended to disappear, especially with the onset of the first frosts. This was particularly well marked in one experimental vineyard in which Aramon gris was interplanted with a few Aramon rouge vines; the vineyard is grafted mainly on Riparia, with a small part on 420 A. In this vineyard rougeau and flavescence were present in the parts given nitrogenous dressings as well as in the unmanured control plots, but the vines which received a heavy application (1 kg. per plant) of potassium sulphate remained unaffected. Chemical analysis of the contents of the flavescent leaves showed them to be deficient chiefly in potash. The affected leaves retained their redness long after the normal ones had begun to show an autumnal colouring, and remained on the branches until the first frosts set in; they were very resistant to frost as well as to mildew [*Plasmopara viticola*].

Analyses of leaves of the same age taken from healthy and affected (flavescent) vines on 23rd September revealed a marked deficiency of potash in the latter. Later on the contents of the leaves are transported to the woody parts of the normal vines, this emigration coinciding with the onset of autumnal colours from October. Of two adjacent vines of the same variety, stock, and age the leaves of one (healthy) developed the usual autumnal appearance while those of the other (with rougeau) remained red,

turgescent, and curved inwards. Analysis of the leaves, branches, and roots on 4th November showed that as regards dry material the leaves and branches of the affected vine were deficient in lime and had an excess of nitrogen and potash in comparison with the healthy vine, while as regards fresh material every constituent (including starch) was present in excess. Evidently therefore the autumn transfer of food and mineral materials had been completely arrested in the affected vines.

It is concluded that flavescence and rougeau are associated mainly with potash deficiency in the aerial organs. In soils which have not been specially fertilized insufficient potash is taken up by the vine, probably owing to some obstacle the nature of which has not yet been determined. When the period of migration of the contents of the green parts sets in in the late autumn, this process in affected vines is arrested, probably as a result of imperfect functioning of the roots in compacted, badly aerated soils, these being those in which rougeau or flavescence first appears and which can be readily improved by applications of potash. Vines grown in pots containing soil to which an excess of potash had been added showed better root development than others in the same soil without the addition of potash. Potash applied to the soil in large quantities, besides being effective against 'brunissure' [ibid., ix, p. 287], thus protects vines against rougeau for several years and improves the qualities of the grapes.

MARCHAL (E.). **Observations et recherches effectuées à la Station de Phytopathologie de l'État pendant l'année 1932.** [Observations and researches carried out at the State Phytopathological Station during the year 1932.]—*Bull. Inst. Agron. et des Stat. de Recherches de Gembloux*, ii, 2, pp. 147–159, 1 chart, 1933.

This report [cf. *R.A.M.*, xii, p. 7] contains among others the following items of phytopathological interest.

In the spring of 1932 an important infection of rye by *Marssonia secalis* Oud. [*Rhynchosporium secalis*: ibid., viii, p. 302; xi, p. 282] occurred in Flanders, where *Gibberella saubinetii* was also very common on wheat.

The opinion previously held by the author that infection by *Hypochnus* [*Corticium*] *solani* does not seriously injure the growth and yield of potatoes under Belgian conditions has now been revised as a result of further information. *C. solani* becomes actively parasitic when the tuber sprouts develop, causing them to remain stunted, the tips withering and dying. In one attack of *C. solani* on the shoots of Eerstelingen [Duke of York] potatoes, the stems developed an apparently secondary infection by *Colletotrichum atramentarium* [ibid., xi, pp. 144, 323] hitherto found only exceptionally in Belgium.

As a rule, sugar beets in Belgium sustain very little injury from leaf spot (*Cercospora beticola*), but in 1932 as a result of leaf development being hastened by the prevailing weather conditions, infections were already general early in September and subsequent spread killed many of the leaves.

Serious injury was caused to turnips growing near Bruges by

*Cercosporella albomaculans* [ibid., viii, p. 269], this being the first record of the fungus in Belgium.

Flax in experimental plots at Gembloux was slightly affected by *Fusicladium lini* [ibid., ix, p. 16].

A bacterial rot of lettuces [? *Bacterium marginale*: ibid., xii, p. 353], beginning as a blackening of the edges of the outer leaves and spreading (frequently very quickly) to the head, reached epidemic proportions in the vicinity of Liége, where it was thought, mistakenly, to have been introduced from abroad; it appears, however, to be known practically all over western Europe, and to have been present near Namur for many years.

Chrysanthemums were attacked by *Sclerotinia fuckeliana*, *Septoria chrysanthemi* [ibid., x, p. 245], *Puccinia chrysanthemi*, *S. rostrupii* [ibid., xi, p. 785], and, in one of the largest nurseries in the country, by *Fusarium dianthi* [ibid., xi, p. 768] which produced collar-canker and caused the plants rapidly to succumb.

Wilting of young plum trees may be caused in Belgium by various fungi; in many cases seen by the author in 1932 the disease was due either to *Verticillium albo-atrum* [ibid., ix, p. 6] or to *Diaporthe perniciosa* [ibid., vii, p. 647].

A comparative study of French and Belgian material of the canker of Canadian poplar [*Populus canadensis*: ibid., xi, p. 94; xii, p. 127] showed the organisms present in the diseased tissues of the trees from both countries to be in all respects similar. In addition to *Nectria galligena*, the author found that the bark over the cankers almost always showed the presence of *Cytospora chrysosperma*, the pycnidial stage of *Valsa sordida* [ibid., x, p. 418]. When cankered branches were sheltered from rain, characteristic orange-coloured cirrhi developed at the edges of the lesions. Very frequently, isolations from affected tissues gave a mycelium developing into blackish pseudostromata from which, in turn, the fructifications of a *Diaporthe* were obtained. Inoculation tests failed to establish the cause of the cankers, but are to be renewed.

*Abies* branches from Bruges showed galls resembling those described by P. Hennings in 1898 on *A. balsamea*, *A. pichta* [*A. sibirica*], and *A. subalpina* [*A. lasiocarpa*] in Berlin as due to *Pestalozzia tumefaciens*; a fungus considered to be this species, though the measurements did not coincide, was isolated from the author's material, constituting a new record for Belgium.

BOLENS (G.), RAPIN (J.), & PAUL (L.). **Rapport d'activité de l'Établissement fédéral d'essais et de contrôle de semences de Lausanne (Mont Calme) durant la période 1927–1932.** [Report on the work of the Federal Experiment and Seed Testing Station of Lausanne (Mont Calme) during the period 1927–1932.]—*Annuaire Agric. de la Suisse*, xxxiv, 4, pp. 425–489, 10 figs., 3 graphs, 1933.

The following items of phytopathological interest occur in this report. Very satisfactory results in the elimination of potato virus diseases were obtained by the cultivation of selected units of varieties such as Centifolia, Early Yellow, Millefleurs, and King George, in mountainous districts for subsequent distribution in the plain [*R.A.M.*, xii, p. 461]. Details are also given of the measures taken

during recent years to test indigenous and imported stocks of seed potatoes for freedom from virus and other diseases, as well as of an extensive series of tests on varietal reaction to wart disease [*Synchytrium endobioticum*], with a list of the varieties officially passed as immune [ibid., xii, p. 189].

In addition to the foregoing potato diseases, the attention of the Station staff has been occupied by studies on a number of cereal diseases and on tobacco wildfire [*Bacterium tabacum*]. Experiments were further conducted with several newly recommended fungicidal treatments, and lectures given on phytopathological and related subjects.

Eastham (J. W.). **Report of Provincial Plant Pathologist.**—*Twenty-seventh Ann. Rept. Dept. of Agric. British Columbia for the year 1932*, pp. U29–U34, 1933.

Comparative tests were conducted in three orchards in the west Kootenays to determine the relative merits of standard lime-sulphur (1 in 40) and of a combination of half-strength lime-sulphur and 6¼ lb. calcium sulphide [*R.A.M.*, ix, p. 792] per 80 galls. in the control of apple scab [*Venturia inaequalis*], six applications being given between 21st April and 23rd June. No appreciable difference was apparent in the efficacy of the preparations, both of which gave satisfactory control in a very severe outbreak of the disease, with profuse development of the pin-head form on the fruit [ibid., viii, p. 155] following heavy rains at the end of August. The latter is a somewhat rare feature, having been observed only three times in the past 18 years.

Some 70 per cent. of the tomatoes in a consignment from Mayne Island showed a black spotting apparently due to *Macrosporium* [*Alternaria*] *solani* [ibid., xi, p. 680 *et passim*], while 5 per cent. had broken down completely. In four other crates examined at Victoria the percentage of black spot ranged from 20 to 43·7. An inspection of the crops on Mayne Island revealed striking contrasts in regard to the incidence of infection, which in some cases caused a practically total loss, while in others only an occasional spot was observed on the leaf or 'nail-head' on the fruit. Another trouble consisted in the development, on the 'shoulder' round the stem-end of semi-ripe fruits, of soft areas with a brownish or freckled appearance, not associated with any micro-organism and probably attributable to the excessive use of chicken manure.

Leaf rust of raspberries (*Phragmidium imitans*) [ibid., ix, p. 535] was prevalent and fairly severe in the Fraser Valley. Raspberry mosaic of the mild mottling type is very general but any pronounced distortion or dwarfing is rare. Certified stock is being produced by three nurseries. Cane blight (*Leptosphaeria coniothyrium*) is the most serious raspberry disease in the districts under observation, though it seldom kills more than 5 per cent. of the canes in a planting or over 25 per cent. of those on an individual plant. Powdery mildew [*Sphaerotheca humuli*: ibid., vii, p. 727; ix, p. 324] was very severe on the Latham variety, preventing inspection for virus diseases in one planting. An undetermined fungus appears to be responsible for a fruit blight of raspberries and loganberries [*Rubus loganobaccus*], infection taking place

through one or more drupelets usually after 1st June; mycelium was detected in the latter and in the adjacent diseased areas of the receptacle.

WOOD (JESSIE I.), STEVENS (N. E.), & MILLER (P. R.). **Diseases of plants in the United States in 1932.**—*Plant Disease Reporter, Supplement* 85, 82 pp., 17 graphs, 10 maps, 1933.

Attention is drawn, in a foreword to this report [cf. *R.A.M.*, xii, p. 493], to the inevitable restrictions on phytopathological investigations in the United States during 1932. Interest was largely concentrated on bacterial wilt of maize (*Aplanobacter stewarti*) [see below, p. 688] and downy mildew of tobacco (*Peronospora hyoscyami*) [ibid., xii, p. 538 and below, p. 732], both of which were remarkable for virulence and extent. Maps are given showing the distribution of white pine blister rust (*Cronartium ribicola*) and phony peach [ibid., xii, p. 575] during the period under review.

**Report of the Louisiana Agricultural Experiment Station for the years 1929–31.**—140 pp., 4 figs., 1 graph, 1 map, [? 1932. Received July, 1933.]

The following items occur in the section of this report dealing with plant pathology (pp. 105–112). C. W. Edgerton, E. C. Tims, and P. J. Mills found that the direct losses from sugar-cane mosaic in the Striped, P.O.J. 36M, P.O.J. 36, and P.O.J. 234 varieties average some 10 per cent. annually [*R.A.M.*, xi, p. 265]. At Reserve the ordinarily resistant P.O.J. 213 and Co. 281 varieties contracted the disease in a virulent form apparently distinct from that occurring elsewhere in the State. Red rot [*Colletotrichum falcatum*: see below, p. 724] has become a serious problem on the P.O.J. 213, P.O.J. 36M, and C.P. 807 varieties, the first-named suffering severely in the field. *F. moniliforme* [*Gibberella moniliformis*], the agent of pokkah boeng disease [ibid., xii, p. 590], was found by P. J. Mills to be of common occurrence on a number of cultivated plants as well as the P.O.J. 234 sugar-cane variety. Inoculation tests with cultures of the fungus from maize, onion, and sugar-cane gave positive results on the latter. E. C. Tims obtained a certain reduction in the infection of sugar-cane in sterilized soil by *Pythium arrhenomanes* [ibid., xi, p. 28] by the inoculation of the soil with some Actinomycetes of proved antagonism to the fungus; no appreciable diminution in the incidence of infection resulted from the omission of maize from the rotation.

Root rot of beans [*Phaseolus vulgaris*] associated with *Rhizoctonia* and *Pythium* spp., was found by L. H. Person to be particularly injurious in the alluvial sections of the State.

Effective control of leaf spot and scorch of strawberry (*Mycosphaerella fragariae* and *Diplocarpon earliana*, respectively) [ibid., xi, p. 463] was obtained by A. G. Plakidas in four years' experiments by spraying with 4–4–50 Bordeaux mixture every ten days from the beginning of January to early March, resulting in a marked increase of yield ($107\frac{1}{4}$ and 219 crates per acre in 1930 and 1931, respectively). The optimum temperature for the development of *D. earliana* was found to be about 10° F. higher than that for *M. fragariae*, a fact that explains the prevalence of the former

during the summer months, while the latter is most severe in the winter and early spring. *M. fragariae* enters the leaf tissues through the stomata and *D. earliana* directly through the epidermis. Several strains of *Pythium* and one species each of *Phoma*, *Fusarium*, and *Rhizoctonia* isolated from decaying strawberry roots proved to be more or less pathogenic in pot experiments.

An [unnamed] fungus was constantly found associated with the rosette or double blossom disease of blackberries and dewberries (*Rubus* spp.), mycelium and spores occurring in the affected blossoms between the floral elements and between the bud scales. Promising results in controlling the disease were obtained by regular applications of 4–4–50 Bordeaux mixture during a period of eight months.

A species of *Sphaeropsis* and (?) *Clitocybe parasitica* [*C. tabescens*: ibid., iv, p. 586] were isolated from the roots of dying Pineapple pear trees, the latter being apparently the main cause of the disease.

BOURIQUET (G.). **Réunion: plant parasites newly recorded in the Island.**—*Internat. Bull. of Plant Protect.*, vii, 6, p. 123, 1933.

The following plant pathogens, all believed to be new to Réunion, were recently observed on the Island by the writer: *Gloeosporium manihotis* on cassava [*R.A.M.*, xii, p. 352]; *Erysiphe cichoracearum* on tobacco [ibid., xi, pp. 333, 677]; *Puccinia maydis* on maize; *P. pruni-spinosae* [ibid., xi, p. 559] and *Taphrina deformans* on peach; *Rhizopus artocarpi* on *Artocarpus integrifolia* [ibid., ix, p. 64]; *Ovulariopsis papayae* [ibid., i, p. 106] on papaw; *Colletotrichum lindemuthianum* and *Isariopsis griseola* [ibid., xi, p. 431] on French beans [*Phaseolus vulgaris*]; *Phytophthora infestans* on potato; *Cercospora* sp. on eggplant; *C.* sp. on *Erythrina indica*; *Sphaerophragmium acaciae* on *Albizzia lebbek*; *Phyllactinia corylea* on mulberry [ibid., x, p. 343]; and *Microsphaera alphitoides* [*M. quercina*] on oak.

STAPP (C.) & BORTELS (H.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. III. Mitteilung. Zur Frage der Bekämpfung.** [Crown gall of plants and its causal organism, *Pseudomonas tumefaciens*. Note III. On the problem of control.]—*Zentralbl. für Bakt.*, Ab. 2, lxxxviii, 13–16, pp. 313–319, 6 figs., 1933.

Twenty plants each of *Pelargonium zonale* (Schöne Ulmerin variety), tomato, and *Datura stramonium* were inoculated in the greenhouse with *Pseudomonas* [*Bacterium*] *tumefaciens* (strain *Chrys*[*anthemum*] *frut*[*escens*] IIb) [*R.A.M.*, xi, p. 357]. Five plants in each of the three series were immediately encircled round the stems by a copper wire similar to Lakhovsky's oscillator for the interception of cosmic rays and their concentration on the plant [ibid., vii, p. 564], a further five in each lot being subjected to the same treatment a month after inoculation. Tumours on another five plants in each series, after two months' development, were exposed to the influence of Röntgen rays, but neither in this

case nor in that of the copper-wire treatment was any remedial effect produced on tumour or plant.

DODOFF (D. N.). **Die epidemische Entwicklung der Weizenroste in Nordbulgarien im Jahre 1932.** [The epidemic development of the Wheat rusts in northern Bulgaria in the year 1932.]—*Phytopath. Zeitschr.*, vi, 1, pp. 111–112, 1933.

The reduction in the 1932 wheat crops of northern Bulgaria from the black and brown rust [*Puccinia graminis* and *P. triticina*] epidemics is estimated at 30 to 100 per cent. in different areas, corresponding to a total financial loss of M. 30,000,000 [*R.A.M.*, xii, p. 150]. Individual farmers were granted a relief from taxation by the Government on account of the excessively heavy damage, and were further supplied with large quantities of wheat for seed and food. It is reported that during a thunderstorm an immense red cloud of rust spores passed over the Danubian plain, after which the harvest was completely destroyed by a renewal of infection. A contributory factor in the development of the epidemics was the protracted severe cold of the previous winter, which delayed the maturity of the plants by ten to twelve days. An experiment showed that the losses from rusts may be considerably reduced by timely sowing, the yield per hect. from 150 kg. seed-grain sown on 25th September, 1931, amounting to 1,925 kg. as compared with 590 kg. from the same quantity sown on 9th November. Generally speaking, the improved commercial varieties were highly susceptible, but a marked degree of resistance was shown by No. 159 R.V.S. and two selections from the Kneja Experiment Station. The system of biennial crop rotation is believed to be largely responsible for the frequent rust epidemics in Bulgaria.

WERNER (O.) & STEINER (H.). **Fortlaufende Körpergewichtsbestimmungen an einer rostkranken und einer gesunden Weizenpflanze.** [Continuous body-weight determinations on a rust-diseased and a healthy Wheat plant.]—*Biol. Gen.*, Vienna, ix (i), 2, pp. 337–354, 7 figs., 1 graph, 1933.

Continuous gravimetric determinations [the results of which are fully discussed and tabulated] on two Carina C.I. 3756 wheat plants, one healthy and one inoculated with brown rust (*Puccinia triticina*), indicated that physiological activity is not impaired for a considerable time after infection, and consequently the reduction of dry weight is negligible.

RIVERA (V.) & CORNELI (E.). **Progressivo estendersi di epidemie da 'Urocystis' su Frumento.** [The progressive extension of epidemics of '*Urocystis*' on Wheat.]—*Riv. Pat. Veg.*, xxiii, 3–4, pp. 171–176, 1933.

Since 1928 wheat growing in the vicinity of Perugia has been attacked with increasing severity by *Urocystis occulta* [generally known on wheat as *U. tritici* Koern.], reported on the same host at Pisa in 1927 and elsewhere in Italy as early as 1908. Infection has now reached epidemic proportions in the first-named locality; for example, one large field of the Virgilio variety near Lake

Trasimeno appeared likely at the time of writing (May, 1933) to lose one-fifth of its crop. The attack occurred early in April, late-sown wheat becoming affected a fortnight afterwards. The disease was equally severe on early sowings made in dry weather in the autumn and late ones made after very wet weather. The prevailing temperature was rather high during the 1932–3 sowing season. Large fields of rye in the same neighbourhood were unaffected, though adjacent fields of Gentil rosso wheat were badly attacked. Virgilio was the most susceptible variety and was affected in numerous parts of Umbria; near Lake Trasimeno Rieti wheat was much less affected than Virgilio or Gentil rosso, and Frassineto was almost immune; in Tuscany, however, the last-named variety was severely affected, and Zara and S. Maria wheats were also attacked. The spores are shed on the ground and germinate on the new seedlings, with the result that the affected areas remain the same but the disease becomes worse in them every year. Seed disinfection and the destruction of diseased material are regarded as likely to give effective control.

In January, 1931, Corneli sowed inoculated, untreated wheat seed in one pot and an equal number of similarly inoculated seeds in another, the latter having been previously immersed for 15 minutes in a 0·5 per cent. solution of copper sulphate and then dipped in milk of lime. On 30th April the untreated seed showed 50 per cent. infection as against only one diseased plant from the treated seed. In 1932 floral infections were made and the seed similarly disinfected before being sown. Although the embryos were presumably exposed to infection, none of the resultant plants showed the disease, from which it is concluded that infection usually results from spores in the soil attacking the wheat at the moment of germination.

ARNAUD (G.) & GAUDINEAU (Mlle M.). **Le traitement de la carie du Blé (1930–31 et 1931–32).** [Wheat bunt control (1930–31 and 1931–32).]—*Rev. Path. Vég. et Ent. Agric.*, xx, 4–5, pp. 188–196, 1 graph, 1933.

This is a summary account of the authors' experiments on the control of wheat bunt [*Tilletia caries*] in the region of Versailles; most of the information contained in it has already been noticed from other sources [*R.A.M.*, xi, p. 566; xii, p. 449].

NIEVES (R.). **La caries o carbón hediondo del Trigo.** [Bunt or stinking smut of Wheat.]—*Bol. Mens. Min. Agric. Nac.*, Buenos Aires, xxxii, 3, pp. 397–411, 3 figs., 1933.

Continuing his studies on wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] in the Argentine Republic [*R.A.M.*, x, p. 781], the writer was able to distinguish two local physiologic forms within the latter species and six within the former [ibid., xii, pp. 429, 618]. In general, the forms comprised within *T. foetens* are more virulent than those of *T. caries*, but form III of the latter, from Pellegrini, approaches those of the former group in virulence. The Lin Calel variety of wheat showed a high degree of susceptibility to all the physiologic forms under observation, whereas Rubión was immune from four, resistant to three,

and susceptible only to form II of *T. foetens*. Certain forms of both species (II of *T. foetens* and II and V of *T. caries*) proved to be capable of attacking rye [ibid., xi, p. 501].

The best control of wheat bunt has been given during seven years' experiments at Guatraché by abavit 26 and uspulun dust, but ibis, Caffaro powder, and vitrioline [see next abstract] may also be recommended for their stimulatory action. The best of the liquid preparations are uspulun-universal, segetan-n[eu], and kalimat. Directions are given for the application of these treatments.

BLANCHARD (E. E.) & CARRERA (D. C.). **Causas que originan pérdidas en los cultivos de Trigos en el sur de la Prov. de Buenos Aires, este y norte de la Pampa.** [Causes responsible for losses among the Wheat crops in the south of the Province of Buenos Aires and in the east and north of La Pampa.]—*Bol. Mens. Min. Agric. Nac.*, Buenos Aires, xxxii, 1, pp. 1–10, 1933.

Foot rot of wheat, caused by *Ophiobolus graminis*, is stated to have been first recognized in the Argentine Republic 25 years ago, since when it has been responsible for severe losses (up to 50 per cent. of the crop) [*R.A.M.*, vii, p. 314]. Other hosts of the fungus include barley, rye, rice, *Bromus sterilis*, and *Hordeum murinum*, the last-named occurring in profusion in the southern part of Buenos Aires. In general, a temperature range of 12° to 16° C. is most favourable to the development of foot rot, which appears both in very damp and in very dry soils and seems also to be favoured by an alkaline reaction. Another form of foot rot in the Argentine is caused by *Helminthosporium sativum*, affecting wheat [cf. ibid., xi, p. 225], barley, rye, and a number of other grasses. The attacks of this fungus are favoured by a temperature range of 28° to 32° and an atmospheric humidity between 55 and 65 per cent., the latter being a particularly important factor in the development of infection in small plantings. Control measures should include rotation with the non-susceptible oats and maize; late sowing of winter wheat; burning of stubble; drainage of damp fields; avoidance of seeds showing a dark coloration of the embryonal area; and seed treatment with a standard dust, e.g., uspulun, abavit, Caffaro powder [ibid., i, p. 66 *et passim*], or vitrioline [ibid., xi, p. 289]. The same preparations are recommended against wheat scab due to *Gibberella saubinetii* (*Fusarium graminearum*), which also causes heavy damage to barley, rye, maize, and other cereals [ibid., xi, p. 505] in the country.

The information on the black, yellow, and brown rusts of wheat (*Puccinia graminis*, *P. glumarum*, and *P. triticina*, respectively) has already been summarized from other sources [ibid., xi, p. 499].

BROADFOOT (W. C.). **Studies on foot and root rot of Wheat. I. Effect of age of the Wheat plant upon the development of foot and root rot.**—*Canadian Journ. of Res.*, viii, 5, pp. 483–491, 1 graph, 1933.

This is an expanded and tabulated account of studies which

have been in progress in Alberta since 1929 to determine whether, in sterilized, inoculated soil, Marquis wheat plants acquire a greater or lesser susceptibility as they grow older after the seedling stage to infection by *Ophiobolus graminis*, *Helminthosporium sativum*, and *Fusarium culmorum* [*R.A.M.*, xi, p. 708; xii, p. 534]. Owing to the complexity of the chemical. morphological, and environmental factors involved in the process of infection, no definite conclusion could be reached on the point at issue, though it was clear that the seedling stage is the most susceptible. It is necessary, for instance, to consider the effects of mutual association on the different fungi, of the development in sterilized soil of foreign micro-organisms, and of the date of inoculation, all of which have some bearing on the occurrence of the disorders under observation.

In sterilized soil, in open pot culture, the inoculum of *O. graminis* was more virulent alone than when mixed with *H. sativum*, *F. culmorum*, or *Leptosphaeria herpotrichoides*, singly or in combination. The virulence of all these fungi, as tested by sowing the seed at 10-day intervals from inoculation of the soil, declined progressively in sterilized (but subsequently unprotected) soil; the decrease was most marked during the first 40 days, after which they were only slightly pathogenic, the inoculum of *O. graminis* being reduced to impotence after 120 days. In unsterilized soil the virulence of the fungi under investigation was greatly diminished in comparison with the results obtained in sterilized soil, being practically at a minimum after ten days.

These data emphasize the importance of protecting inoculated, sterilized soil against contamination by other micro-organisms in critical studies made in soil [cf. ibid., x, p. 719], and further help to explain the recognized difficulty of inducing foot rot in the field by the addition to the soil of prepared inoculum.

Broadfoot (W. C.). **Studies on foot and root rot of Wheat. II. Cultural relationships on solid media of certain micro-organisms in association with Ophiobolus graminis Sacc.**—*Canadian Journ. of Res.*, viii, 6, pp. 545–552, 1 pl., 1933.

A comparative investigation was made of the antagonistic and compatible growth relationships of 66 cultures of bacteria and fungi, mostly from the soil, in association with *Ophiobolus graminis* on potato dextrose and Molisch's peptone agar and on wheat seedlings in open soil culture in Alberta [*R.A.M.*, xii, p. 109 and preceding abstract].

Of the 21 organisms controlling the virulence of the fungus in the soil, 15 were also antagonistic on potato dextrose agar, including *Wojnowicia graminis* [ibid., xii, p. 157 and next abstract], *Plenodomus meliloti* [ibid., xii, p. 635], *Helminthosporium sativum*, *Bacterium translucens* [var.] *undulosum* [ibid., xi, p. 434], *P. chelidonii*, *Botrytis cinerea*, and various bacteria. Of the 45 organisms giving only moderate or no control of *O. graminis* in the soil, 28 unexpectedly proved to be decidedly antagonistic in culture, including another strain of *H. sativum*, *Leptosphaeria herpotrichoides*, *Sclerotinia* sp., *Ascochyta graminicola* [ibid., xi, p. 768], and *P. destruens* [ibid., xi, p. 535]. *Typhula graminum* [ibid., x,

p. 235] gave moderate control of *O. graminis* in the soil and was antagonistic to it on Molisch's medium but compatible on potato dextrose.

Considering the phenomena of compatibility and antagonism in relation to the final hydrogen-ion concentration of the medium in which the organisms were grown, it was found that 11·6 per cent. of the 43 cultures showing antagonism to *O. graminis* on the solid substratum gave $P_H$ values between 3·8 and 5·4, 58·1 per cent. between 6·0 and 7·4, and 7 per cent. between 8·0 and 9·0, the rest being intermediate. Of the 23 compatible cultures, 8·7 per cent. gave values between $P_H$ 3·8 and 5·4, 65·2 per cent. between 6·0 and 7·4, and 13 per cent. between 8·0 and 9·0. Thus, the largest number in both groups had $P_H$ values between 6·0 and 7·4, the optimum range, according to Davis and to Webb and Fellows [ibid., vi, p. 217] for the growth of *O. graminis*. A possible explanation of the seemingly conflicting results with regard to antagonism and compatibility obtained in certain cases is that the various micro-organisms produce metabolic substances differing in kind and in amount according to the substratum. It is in any case unsafe to predict the behaviour of a given organism towards *O. graminis* in the soil from its relations with the fungus in culture.

FOËX (E.) & ROSELLA (E.). **Quelques observations sur le piétin des céréales.** [Some observations on foot rot of cereals.]—*Rev. Path. Vég. et Ent. Agric.*, xx, 4–5, pp. 172–187, 1933.

In this paper the authors give considerable details of their studies on *Cercosporella herpotrichoides* in the neighbourhood of Paris, the results of which mainly confirmed the observations already communicated in a previous note [*R.A.M.*, xii, p. 560] on the part played by this fungus in the etiology of the foot rots of cereals in that region [ibid., xi, p. 503; xii, p. 157]. It is pointed out that since 1928, of all the organisms involved in these diseases, *Ophiobolus graminis* and *C. herpotrichoides*, and to a certain extent *Wojnowicia graminis*, are the only fungi responsible for serious damage to cereal crops at Versailles and in the vicinity, while *Leptosphaeria herpotrichoides* and *O. herpotrichus* have only been isolated from sheaves that had overwintered in the field. There also was confirmation that although *C. herpotrichoides* is intrinsically a less virulent parasite than *O. graminis*, it usually is more dangerous to the crops, as it generally attacks them early in autumn, continues to develop during mild and wet winters, and its dispersion in the spring is ensured by the formation of abundant conidia.

While for the most part *W. graminis* only attacks weakened plants, it usually accompanies *C. herpotrichoides* and *O. graminis*, and the lesions caused by it are less definitely localized than those of *C. herpotrichoides* to the leaf sheaths and culm bases; it is frequently found also in the root system, but does not cause in it the dark brown discoloration associated with attacks of *O. graminis*. In the south of France and in Morocco it is capable of more serious injury and can cause lodging of the wheat.

KLEMM (M.). **Auswinterungsschäden im Winter 1932/33.** [Winter injury in the winter of 1932–33.]—*Mitt. Deutsch Landw.-Gesellsch.*, xlviii, 23, p. 513, 1 map, 1933.

Cereals in Germany suffered comparatively little from winter injury, chiefly associated with *Fusarium nivale* [*Calonectria graminicola*: *R.A.M.*, xii, pp. 277, 502] during 1932–3, ploughing up over areas of up to 20 per cent. of the total under cereal cultivation being generally necessary only in parts of Hanover, East Prussia, and the Rhine Province.

STOREY (H. H.). **Investigations of the mechanism of the transmission of plant viruses by insect vectors. I.**—*Proc. Roy. Soc.*, London, Ser. B., cxiii, 784, pp. 463–485, 1 pl., 1 fig., 1933.

After a brief reference to his discovery [a short account of which was noticed in *R.A.M.*, x, p. 652, the full paper being published in *Proc. Roy. Soc.*, London, Ser. B., cxii, 774, pp. 46–60, 1932] of 'active' and 'inactive' races of *Cicadulina mbila* in the transmission of maize streak [*R.A.M.*, xi, pp. 66, 591], the author describes in detail a method by which he successfully inoculated the streak virus into a large number of inactive, and active but not infective, individuals of these insects and inactive ones of a second species, *C. zeae*. The inoculum consisted of fresh juice of young diseased maize seedlings; when kept in the dark at 23° C. this fluid retained its infective capacity up to the fourth day after preparation, but was not infective on the eighth day, and it was able to cause the insects to become 'active' (i.e., viruliferous) by heavy inoculation into them when diluted with distilled water by $10^{-2}$ and rarely by $10^{-3}$. Roughly stated, the inoculation itself consisted in the introduction of the virus into a puncture of the abdomen or leg made with a finely pointed needle or glass micro-pipette. During the whole work a single strain of streak, maintained on maize seedlings in the greenhouse, was used and showed no signs of splitting up.

The results showed that of 150 previously non-infective individuals of active *C. mbila* (including both sexes of adults and also nymphs) which were inoculated, a total of 106 transmitted the disease when placed on healthy maize plants. The infections caused by them in short periods of exposure were, however, more irregular that those caused by insects made infective by feeding on a source of the virus (e.g., a diseased leaf), and the disease usually developed in the plant more slowly. Ultimately the inoculated insects became non-infective, whereas the insects which had taken the virus by mouth usually retained their infectivity up to their death. Attempts to render the insects infective by drawing up the virus into the rectum through the anus gave negative results, and it would appear that the lower part of the alimentary canal may retain the virus without causing the insect to be able to transmit the disease.

Inoculations into non-infective active individuals of the fluid obtained from different parts of infective ones showed that in the latter the virus was present (*a*) in the contents of the rectum, if the insect had recently fed on a diseased plant, but not otherwise;

(*b*) in the general contents of the thorax or abdomen; and (*c*) in the blood, whether the insect had fed recently upon diseased or healthy plants. The virus was not found in the naturally voided faeces, and its appearance in the blood preceded the development in the insect of the power to cause infections.

The needle inoculation was also effective in rendering inactive races of *C. mbila* infective, but the proportion of successes was significantly less than with active races. Individuals of these races that had not been inoculated by puncturing were shown to harbour the virus in their rectum after a recent feed on a diseased plant, but never in the blood. A simple puncture of the abdomen by a sterile needle, however, either following or preceding a feed on a diseased plant, sometimes caused inactive individuals to become infective, the indications being that the treatment was effective only if some part of the intestine was punctured by the sterile needle.

The same methods were also successful in rendering inactive races of *C. zeae* infective, but attempts to inoculate the viruses of maize stripe and mosaic into *C. mbila*, or the virus of streak into *Peregrinus maidis* and *Aphis maidis*, all gave negative results.

The results of these investigations lead the author to believe that the streak virus, after absorption by the insect through the mouth. enters the intestine, and in active *C. mbila* races passes from there into the blood through the intestinal wall at some point higher up than the rectum, while in inactive races the intestinal wall is impenetrable to the virus throughout; the latter suggestion is supported by the fact that a rupture in the intestinal wall caused by pressure, allowing the access of the virus to the insect's blood, made many inactive individuals to transmit streak like active insects. It is recognized, however, that there may also exist some secondary mechanism of resistance in the inactive insects.

**Bacterial wilt of Corn.**—*Plant Disease Reporter*, xvii, 8, pp. 97–98, 1933. [Mimeographed.]

All the available evidence indicates that in 1933 the losses in the United States from bacterial wilt of maize (*Aplanobacter stewarti*) [*R.A.M.*, xii, p. 562] may even exceed those of the previous two years, strains and hybrids previously considered as resistant now showing a relatively high susceptibility.

Observations made in June, 1933, showed that in Hampden County, Massachusetts, almost every field had from 1 to 85 per cent. primary infection, as against a maximum of 1 or 2 per cent. in 1932; in Connecticut 65 per cent. infection was occasionally present; in Pennsylvania infection was general, affecting 70 per cent. of the plants in many fields; and in Ohio a number of fields showed 70 per cent. infection and others had already been ploughed up. The disease was also very severe in Michigan, though not of commercial importance in this State before 1932. In Indiana almost all varieties showed higher percentages of infection than in the year before, and in Illinois different varieties of yellow sweet corn showed 26 to 78 per cent. infection. In Arkansas the disease was recorded for the third time in the last 15 years.

Rand (F. V.) & Cash (Lillian C.). **Bacterial wilt of Corn.**—*U.S. Dept. of Agric. Tech. Bull.* 362, 30 pp., 3 pl., 2 graphs, 1933.

Continuing their studies on bacterial wilt (*Aplanobacter stewarti*) of maize [*R.A.M.*, iv, p. 162] the authors state that the disease occurs primarily in the south and centre of the United States [ibid., xii, p. 281, and preceding abstract], and is rare or non-existent in the most northern States. Although there was clear evidence that it is transmissible through infected seed-grain (the organism was isolated from inside grain from diseased plants at least five months after harvest), and that plants raised in the greenhouse from such seed gave from 2 to 13 per cent. infection, it is considered that transmission by this means is important only in introducing the wilt into new localities. This is supported by the fact that when seed-maize imported from regions where the disease does not occur, was sown in localities where it is prevalent, the ensuing crops exhibited startling amounts of the disease, as high as 96 per cent. in some varieties imported from Maine to Maryland.

In field experiments, from which insects were not precluded, no significant differences were noticed in the amount of wilt developing in plants raised from healthy seed sown in artificially inoculated soil or in non-inoculated soil that had not been in maize for at least two seasons. In field and greenhouse experiments in which the insects were controlled, however, no wilt resulted in inoculated soil, except in a few plants that had been subjected to severe root pruning, followed by immediate inoculation of the soil in contact with the cut roots [ibid., xi, p. 446]. This is interpreted to indicate that although overwintering of *A. stewarti* in the soil may conceivably take place on rare occasions, it is not likely to occur and is of no practical significance in the field. It was further shown that while weather conditions, such as temperature and rainfall, soil moisture, and also the condition of growth of the host, have a considerable influence on infection and the subsequent development of wilt, these factors are often quite overshadowed by dissemination of the organism by insects, among which the brassy and toothed flea beetles (*Chaetocnema pulicaria* and *C. denticulata*) have been definitely shown to be responsible for the main summer spread, at least in Maryland.

Comparative tests of some 60 [named] varieties of maize indicated the existence of wide differences in their relative resistance to wilt, the general trend being for the earlier varieties to be more susceptible than the later maturing ones.

The investigation indicated that in localities where bacterial wilt is prevalent seed-grain disinfection is of doubtful value owing to secondary summer dissemination of the organism. Seed treatment is only of use for the prevention of the introduction of the disease into new areas, and is difficult since the organism is carried inside the grain. Laboratory experiments, however, indicated that subjecting infected seed-grain to dry heat at a temperature well above the thermal death point (53° C.) of *A. stewarti* for a period of time sufficient to allow the heat to reach all the parts of the seed was effective in killing the parasite without materially

reducing the germination of the seed or the vigour of the resulting plant.

[WALTERS (E. A.).] **Report on the Agricultural Department, St. Lucia, 1932.**—39 pp., 1933.

In the section of this report dealing with plant diseases (pp. 13–14) it is stated that owing to wet weather during the first five months of the year there was some extension of wither-tip of limes (*Gloeosporium limetticolum*) [*R.A.M.*, xi, p. 698] in St. Lucia during 1932. Subsequent wet, cold weather led to an onset of the blossom blight stage in November. As a result of these conditions the crop is expected to show a decrease of 11 per cent. as compared with that of the preceding year.

Scab [*Sporotrichum citri* or *Sphaceloma fawcettii*: ibid., xii, p. 625] of sour orange [*Citrus aurantium* var. *bigaradia*], comparatively unknown before 1931, has now become one of the most troublesome diseases in nursery work, its spread having been facilitated by the accumulation of a large number of stocks in the nurseries; spraying and handpicking were carried out systematically and were effective when drier weather prevailed. At present only nurseries on the heavier soil are affected.

JENKINS (ANNA E.). **A Sphaceloma attacking Navel Orange from Brazil.**—*Phytopath.*, xxiii, 6, pp. 538–545, 1 fig., 1933.

Bahia Navel oranges (*Citrus sinensis*) in São Paulo, Brazil, are stated to be severely attacked by a variety (*viscosa*) of *Sphaceloma fawcettii* [see preceding abstract] characterized by an abundant viscid growth on wort-agar cultures, ranging from buffy citrine through buffy olive to medal bronze (Ridgway). The acervuli on orange rind are dark-coloured (nearly old gold in section), about 40 $\mu$ across, the 0- to 3-septate conidiophores measure 6 to 18 by 4 to 5 $\mu$, and the conidia 6 by 4 $\mu$; hyaline conidia of similar dimensions are produced in culture. On potato-dextrose agar the navel orange scab fungus differs from the type in its light orange-yellow coloration as well as by the above-mentioned viscid secretion. In its temperature relations, however, *S. fawcettii* var. *viscosa* agrees closely with cultures of the type species originating in the United States, Australia, South Africa, and Formosa from several kinds of citrus (not including the *C. sinensis* group). Specimens of the type of scab on sweet orange described by G. L. Fawcett from the Argentine [ibid., x, p. 654] resembled the navel orange scab more closely than the usual form of *S. fawcettii*. Navel orange scab appears to be confined to the fruit, which is frequently rendered unmarketable by the disease.

PARK (M.). **Citrus mildew.**—*Trop. Agriculturist*, lxxx, 5, pp. 321–322, 1 col. pl., 1933.

In the wetter areas of Ceylon the mildew *Oidium tingitaninum* is very common on the leaves of several species and varieties of *Citrus*, a list of which is given [*R.A.M.*, xii, p. 166].

The disease usually appears in small isolated spots, on which the fungus forms fine radiating lines, on the edges of the young leaves. In damp weather the succulent young shoots also become

covered with the mildew. The diseased leaf surface darkens and generally is depressed, and the youngest leaves shrivel and fall, leaving the bare, green twig, which dies back; the young growth of orange-trees is sometimes completely destroyed in this way. As a rule, however, some irregularly buckled, distorted, larger leaves remain. The spores are disseminated by wind or rain.

Complete control is given by two or three applications of a sulphur spray [loc. cit.] during the growing period. Dead and dying shoots and branches should be pruned off, and young suckers should not be allowed to grow up from the bottom of the tree. Severely affected shoots should be removed and burnt.

FAWCETT (H. S.), KLOTZ (L. J.), & HAAS (A. R. C.). **Water spot and water rot of Citrus fruits.**—*California Citrograph*, xviii, 6, pp. 165 and 175, 4 figs., 1933.

Considerable losses (averaging one year 40 per cent. of the crop) are stated to have been caused to navel oranges in the east of Los Angeles county and other districts of California, by a serious rind break-down (for which the descriptive name 'water spot' is suggested), first seen in 1927, with severe recurrences in 1929, 1930, 1932, and 1933, following more or less prolonged rainy periods in the early spring. Unless checked by the onset of dry weather, the condition is usually followed by a soft rot of the whole orange due to secondary fungi. Experiments and field observations indicated that the trouble, which mainly affects nearly ripe oranges on the tree, is due to imbibition of water through weak spots and slight injuries in the rind caused by various agencies, most of which are not controllable, though some may be minimized by adequate precautions in spraying and fumigating the trees. The condition was experimentally reproduced in mature Valencia oranges and lemons by soaking them for 36 hours in distilled water.

QUAYLE (H. J.). **Bordeaux spraying and fumigation injury.**—*California Citrograph*, xviii, 6, pp. 166 and 184, 1933.

The author states that the results of experiments in 1932 with lemon seedlings in pots and various citrus trees in the field showed that injury to the trees from cyanide fumigation following Bordeaux mixture ensued even on those plants which had been sprayed with the neutral or approximately neutral (4–0·8–50) Bordeaux mixture recommended by Butler and Jenkins [*R.A.M.*, ix, p. 732], although it was markedly less than on those that had been treated with the normal (4–4–50) formula. Further experiments showed that citrus trees that had received 3 or 5 lb. applications of copper sulphate on the ground around them (as used in treating exanthema) two and three years previously, suffered heavy defoliation when fumigated, while controls remained uninjured. Tests with other copper compounds, including copper carbonate and copper acetate, showed that these were also injurious on fumigation, although the injury was less than with copper sulphate. These results indicate the desirability of finding a substitute for copper in the treatment of citrus groves against brown rot [*Phytophthora citrophthora*], and work is in progress to establish the efficacy in

the field of a zinc sulphate-lime spray (4–4–50), which has been reported by Fawcett to check the brown rot quite satisfactorily in the laboratory.

**La frisolée foliaire du Caféier.** [Leaf crinkle of the Coffee tree.] —*Rev. Agrol. et Bot. du Kivu, 1933*, 2, p. 24, 1933.

Attention is drawn to the occurrence of a leaf crinkle in the Kivu [Belgian Congo] coffee plantations. The disturbance is attributed to physiological causes—drying winds and abrupt alternations of day and night temperature—rather than to parasitic agency or to a virus. The establishment of windbreaks and of shade is indicated.

MOORE (ELIZABETH J.). **Growth relations in culture of the Cotton-root-rot organism, Phymatotrichum omnivorum.**—*Phytopath.*, xxiii, 6, pp. 525–537, 2 graphs, 1933.

The writer's laboratory experiments [the results of which are fully discussed and tabulated] at Texas University showed that a given culture of the cotton root rot organism (*Phymatotrichum omnivorum*) [*R.A.M.*, xii, p. 628] grows at a fairly constant rate on potato-dextrose agar but that different isolations varied considerably, one recently isolated, for instance, averaging nearly three times the rate maintained by two others that had been kept for long periods on artificial media. On addition to potato-dextrose agar cotton-root extracts greatly accelerated the rate of elongation of the hyphae. On the other hand, freshly prepared maize root extracts, either alone or combined with potato-dextrose agar, proved strongly toxic to all the strains of *P. omnivorum* tested. Such water-soluble substances present in maize roots are labile but show a diminished toxicity on ageing. Small doses of the toxin appear to stimulate the growth of the fungus. A similar toxic effect was exerted in varying degrees by extracts from the roots of *Malvaviscus conzattii* (the only species of Malvaceae known to be highly resistant to *P. omnivora*) [ibid., xi, p. 640], wheat, and barley. It is considered, therefore, that the water-soluble, labile substances present in the roots of plants immune from infection by *P. omnivorum* play a part in the establishment of this condition.

STOVALL (W. D.) & BUBOLZ (ANNA A.). **Yeast-like fungi.**—*Journ. Lab. & Clin. Med.*, xviii, 9, pp. 890–902, 7 figs., 1933.

A review is given of the literature on the classification of yeast-like fungi, attention being drawn to the confusion that has led to a multiplicity of species of *Monilia* and resulted in the grouping of all yeast-like organisms as *Blastomyces* [cf. *R.A.M.*, viii, p. 103 *et passim*].

The characteristic differences of certain of these types of fungi are described. Such differences were found to be typical of the various species and to persist through periods of many years under controlled conditions in artificial cultivation.

Brief clinical reports are given of some cases of infection by *Monilia* [*Candida*] spp., which sometimes appear to be responsible for asthma [see next abstract]. These organisms further seem to

be associated with lesions in various parts of the body, *M. candida* [*C. vulgaris*: ibid., xi, p. 373], for instance, being found connected with thrush in one patient and with vaginitis in another [ibid., xii, p. 370]. Careful clinical and laboratory studies established yeast-like fungi as the primary etiologic agents in certain cases of pulmonary, vaginal, and buccal mucous membrane inflammation.

MARETT (P. J.). **Monilia infection of the respiratory tract.**—*Brit. Med. Journ., 1933*, 3777, p. 917, 1933.

The examination during 1932 of the sputa of 568 patients in Jersey (Channel Islands) both by direct and cultural methods showed that tuberculosis was present in 103, *Monilia* [*Candida*] in 294, the remaining 171 being free from either [cf. *R.A.M.*, xi, p. 715]. Details are given of the author's cultural and staining work on the species of *Candida* thus isolated. In the air passages infection by *Candida* results either in ulceration, haemorrhage, and bronchiectasis, or in occlusion and collapse of the alveoli at the distal end of the bronchioles, with consequent cavitation, manifested by 'fluffing' of the lung tissue on X-ray examination. These conditions are often found in combination.

The allergic symptoms of moniliasis resemble those associated with analogous diseases, such as hay fever, asthma and bronchiectasis, and tuberculosis, and it is suggested that the acid-fast substance found in the associated organisms in all these diseases is the 'foreign protein' common to all and the inciting cause of the various allergic reactions known to occur in them.

HALER (D. H.). **Monilia infection of respiratory tract.**—*Brit. Med. Journ., 1933*, 3781, p. 1130, 1933.

P. J. Marett's claim that *Monilia* [*Candida*] is of primary importance in the causation of pulmonary disease [see preceding abstracts] cannot be accepted by the writer in view of the high incidence of this group of organisms in the respiratory tract of apparently normal persons. Unquestionably these fungi may gain access to the bronchi in cases of subnormal health of the mucosa, but here their action is obviously secondary.

STILES (G. W.), SHAHAN (M. S.), & DAVIS (C. L.). **Coccidioidal granuloma in cattle in Colorado.**—*Journ. Amer. Veter. Med. Assoc.*, lxxxii (N.S., xxxv), 6, pp. 928–930, 1933.

*Coccidioides* [? *immitis*: *R.A.M.*, xii, p. 288] was isolated from a lymph node of a heifer at Denver, Colorado, in 1931, this being apparently the first record of coccidioidal granuloma in animals outside California. The diseased gland was enlarged and contained several encapsulated areas 3 to 8 mm. in diameter. The tissue was traversed by numerous trabeculous striations giving a honeycomb appearance to the surface of the section. The organism appeared in the form of spherical, double-contoured bodies, 10 to 40 $\mu$ in diameter, with a granular protoplasm; some of the larger individuals contained small spheres suggestive of daughter cells. The fungus grew well on meat infusion agar and other standard media and produced positive results on inoculation into guinea-pigs.

DESSY (G.). **La chimiothérapie des mycoses. IIIème Partie: Mucoro-mycose. Ière Communication: expériences 'in vitro'.** [The chemicotherapy of mycoses. Third Part: Mucor-mycosis. First communication: experiments '*in vitro*'.]—*Boll. Sez. Ital. della Soc. Internaz. Microbiol.*, v, 4, pp. 95–107, 1933.

In this series of experiments [cf. *R.A.M.*, xi, p. 715] the author tested the growth-inhibitory and fungicidal power *in vitro* on *Mucor mucedo, M. pusillus, M. roseum, M.* sp. (Calmette) and *M.* sp. (Boidin), of 51 colouring agents and 22 metallic salts. The growth in culture of all the organisms was inhibited by brilliant green (1 in 40,000), malachite green (1 in 40,000), and crystal violet (1 in 10,000 to 1 in 500 according to the species). Dahlia (1 in 5,000 to 1 in 500) and gentian violet (1 in 10,000 to 1 in 2,000) prevented the growth of all except *M. roseum* and *M.* sp. (Calmette), while methylene violet and methyl violet (1 in 10,000 to 1 in 500) were inhibitory to all but *M.* sp. (Calmette). The most effective metallic salts were copper sulphate (1 in 2,000), copper chloride (1 in 2,000 to 1 in 1,000), copper acetate (1 in 1,000 to 1 in 500), zinc sulphate (1 in 1,000 to 1 in 500), zinc acetate (1 in 2,000 to 1 in 500), nickel sulphate (1 in 10,000 to 1 in 2,000), nickel chloride (1 in 10,000 to 1 in 2,000), cobalt chloride and nitrate (1 in 10,000 to 1 in 2,000), cadmium chloride (1 in 2,000 to 1 in 1,000), cadmium sulphate (1 in 1,000 to 1 in 500), cerium nitrate (1 in 1,000 to 1 in 500), mercuric chloride (1 in 2,000), and mercury cyanide (1 in 10,000 to 1 in 2,000). All the above-mentioned dyes, except malachite green, were shown to have a fairly strong fungicidal power (as distinct from their inhibitory action) on the organisms, while among the metallic salts those of mercury and copper were the most fungicidal.

DAVIDSON (A. M.) & GREGORY (P. H.). **Development of fuseaux, aleuriospores, and spirals on detached hairs infected by ringworm fungi.**—*Nature*, cxxxi, 3319, pp. 836–837, 1 fig., 1933.

When human hairs infected by *Trichophyton gypseum* [*R.A.M.*, xii, p. 218] were exposed in van Tieghem cells to various degrees of humidity controlled by solutions of known osmotic pressure, the chlamydospores germinated rapidly, each hair slowly becoming surrounded by a fringe of mycelium. The ends of many of the hyphae thickened and formed macroconidia ('fuseaux'), which increased in size and numbers until a halo was produced round the hair. Conidia (aleuriospores) and spirals were also formed under the same conditions, and similar tests with *M. audouini* and *M. felineum* have yielded identical results. It is evident, therefore, that the ringworm fungi present in naturally infected hairs may, under suitable conditions of humidity, develop organs hitherto found only in artificial cultures. Cast-off hairs and epidermal scales may well provide a suitable substratum for the saprophytic existence of these fungi and enable them to produce spores capable of infecting new human and animal hosts.

MUSKATBLIT (E.) & OUSPENSKY (B.). **Influence of grenz rays on pathogenic fungi in skin material.**—*Arch. of Dermatol.*, xxvii, 6, pp. 953–955, 1933.

Hairs containing pathogenic fungi were taken from children with tinea capitis and exposed to grenz rays, the viability of the organisms being subsequently tested by planting the treated hairs on a culture medium.

In doses up to 50,000 roentgens, i.e., over 70 times larger than the average single dose used in the treatment of fungous diseases of the skin, the grenz rays failed to influence the growth of *Microsporon audouini*, *M. lanosum*, *Achorion schoenleini*, and *Trichophyton crateriforme* [*R.A.M.*, xii, p. 443]. *T. violaceum*, however, completely succumbed to exposure to 50,000 roentgens in two tests and was temporarily inactivated at this strength in a third.

The therapeutic effects of grenz rays in dermatomycoses would thus seem to be due to the changed properties and reaction of the skin rather than to direct inhibitive action on the fungi.

JAUSION (H.) & DUFESTEL (L.). **Sur l'action vaccinante de lysats pancréatiniques et diastasiques de dermatophytes.** [On the vaccinating action of the pancreatinic and diastatic lysins of dermatophytes.]—*Comptes rendus Soc. de Biol.*, xciii, 24, pp. 868–870, 1933.

Twenty strains of *Epidermophyton floccosum* [*R.A.M.*, xii, p. 630] and ten of *Achorion schoenleini*, cultured for four months on honey agar, were subjected separately to the enzymatic action of (1) pancreatin, containing trypsin and amylase; and (2) diastase of sprouted barley containing amylase and dextrinase. After ten hours in the autoclave at 55° C. and 30 minutes at 100°, filtration, clarification, and adjustment to an appropriate hydrogen-ion concentration ($P_H$ 7·2), the extracts were used for treating human dermatomycoses. One case of favus and six of inguinal epidermophytosis were successfully treated by 12 injections in a period of one month, using the diastatic and pancreatinic extracts of *A. schoenleini* in the first and those of *E. floccosum* in the others. Similar experiments with other dermatophytes are in progress.

OTA (M.) & KAWATSURÉ (S.). **Sur l'inoculabilité à l'animal du Trichophyton interdigitale Priestley.** [Note on the inoculability into animals of *Trichophyton interdigitale* Priestley.]—*Ann. de Parasitol. Humaine et Comp.*, xi, 3, pp. 206–221, 1 pl., 1933.

Details are given of experiments in which the authors succeeded in inoculating five strains of *Trichophyton interdigitale* isolated from man to guinea-pigs, in which they caused a distinct, if weak infection of the hairs. These results dispose of the only reason (un-inoculability into animals) for separating this fungus from the collective species *Ctenomyces mentagrophytes* suggested by Langeron and Milochevitch [*R.A.M.*, x, p. 243] (to include this organism together with *T. asteroides*, *T. granulosum*, and *T. radiolatum*), which is accepted by the authors; they consider, however, that until the formation of ascospores and perithecia is definitely proved in these fungi, they ought to be retained among the Hyphomycetes,

and should be known under the name *Sabouraudites mentagrophytes*, in which *T. lacticolor* should also be included, as the characters distinguishing it from *T. asteroides* are very slight.

The authors also claim to have established that *T. radians*, *T. denticulatum*, and *T. pedis* are one and the same species, and consider that they could be conveniently reunited with, and known under, the name of *T. niveum*, a name which is preferred to *T. felineum* Blanchard because of the danger of confusion between the latter and *Microsporon felineum* (*Sabouraudites felineus*).

NEGRONI (P.). **Onycomycose par Cephalosporium spinosum n. sp. Negroni, 1933.** [Onychomycosis caused by *Cephalosporium spinosum* n. sp. Negroni, 1933.]—*Comptes rendus Soc. de Biol.*, cxiii, 21, pp. 478–480, 1933.

*Cephalosporium spinosum* n. sp., isolated in the Argentine from discoloured areas on the toe-nails, is characterized on Czapek's medium by greyish-white colonies with reddish-purple zones, sterile rampant hyphae forming spines of interlaced, very slender, hyaline, branched, septate, filaments, 1·5 to 2 $\mu$ in diameter; simple conidiophores, 27 to 28 by 1·3 to 1·5 $\mu$, tapering at the apices; and oval or elliptical, hyaline, smooth spores, 4·89 by 3·26 $\mu$, borne at the tips of the conidiophores in conglomerate heads united by a mucous substance. The optimum temperature for the development of the fungus is about 28° C. Details are given of its development on Sabouraud's and Raulin's media.

RIESS (G.) & LUDORFF (W.). **Ausländische gesetzliche Bestimmungen über die chemische Konservierung von Lebensmitteln.** [Foreign legal regulations concerning the chemical preservation of foods.]—*Arb. aus dem Reichsgesundheitsamte*, lxvi, 1, pp. 119–164, 1933.

A summary is given of existing legislation on food preservation in countries outside Germany, showing the maximum amounts permissible of the various chemicals employed for this purpose, e.g., sulphuric, salicylic, and benzoic acids [*R.A.M.*, xii, p. 524].

OLSON (H. C.) & HAMMER (B. W.). **Bacteriology of butter. V. Studies on the micro-organisms in churns.**—*Iowa Agric. Exper. Stat. Res. Bull.* 159, 120 pp., 10 figs., 2 graphs, 1933.

The results of the investigation reported in detail in this communication showed that the microbiological condition of the churns in commercial use is of considerable importance as a source of contamination of butter with bacteria, yeasts, and moulds [cf. *R.A.M.*, xii, p. 219], as evidenced by the fact that fresh unsalted butter from contaminated churns was found to contain an average of 277,700 bacteria, 8·2 yeasts, and 1·3 moulds per c.c., while the corresponding numbers for similar butter from clean churns were 21,740, 1·4, and 0·6, respectively. The average bacterial count of cream pasteurized at 145° F. was 336,500, while that pasteurized at 155° had 60,300 per c.c.; the former sometimes contained significant numbers of yeasts and moulds, while in the latter these organisms were practically eliminated. The paper also gives

details of experiments on different methods for the control of the micro-organisms in the churns.

Morgan (G. F. V.) & Moir (G. M.). **Discoloration in New Zealand Cheddar cheese. Muddy, pink and bleached defects. I. Bacteriological investigations. II. Biochemical investigations.**—*Journ. Dairy Res.*, iv, 2, pp. 226–245, 2 figs., 1933.

The evidence of high $P_H$ and high catalase activity confirmed the view that mould (*Penicillium puberulum*) growth is closely associated with the development of the 'bleached', 'pink', and 'muddy' types of discoloration in New Zealand Cheddar cheese, which are stated to be responsible for heavy losses amounting to hundreds of pounds per annum. The pink discoloration appears to result from the action of acids on the annatto colour, bleaching from a reduction process involving changes in the fat, and the muddy or dark tinge from enzymes (possibly including tyrosinase) diffusing into the cheese from centres of mould growth.

Parsons (B.) & Massey (L. M.). **Rose-disease investigations. Fourth progress report.**—*Amer. Rose Ann., 1933,* pp. 87–101, 1933.

Continuing their field trials in Pennsylvania on the control of rose diseases [*R.A.M.*, xii, p. 25], the writers found that black spot (*Diplocarpon rosae*) [ibid., xii, p. 570] was best combated by the sulphur dusts kolotex, pomodust, manganar, and kolodust, and (though somewhat less effectively) by Bordeaux mixture and by flotation sulphur [see below, p. 708]. Less satisfactory results were given by lime-sulphur and various wettable sulphur sprays without lead arsenate. Brown canker (*Diaporthe umbrina*) [ibid., xii, p. 25] yielded to the same treatments as black spot, but neither disease was very severe during the fourth season of the tests, and the incidence of mildew (*Sphaerotheca pannosa*) was negligible.

White (R. P.). **The insects and diseases of Rhododendron and Azalea.**—*Journ. Econ. Entom.*, xxvi, 3, pp. 631–640, 2 pl., 1933.

Semi-popular notes are given on the symptoms and control of the following diseases affecting rhododendrons and azaleas in the United States: leaf spots caused by *Cercospora rhododendri* [*R.A.M.*, vi, p. 258] and *Puccinastrum minimum* [*Thecopsora minima*] (both on *Rhododendron ponticum*); *Melampsoropsis piperiana* on *R. californicum*; *Exobasidium vaccinii* on various species; *E. oxycocci* [ibid., x, p. 532; xi, p. 188] on *R. maximum* and *R. catawbiense*; *Phyllosticta saccardoi*, *P. maximi* [ibid., xi, p. 518], and *Phomopsis* sp. (the latter causing a leaf spot and canker) on *R. maximum*; *Lophodermium rhododendri* on the same and *R. californicum*; mosaic [ibid., xi, p. 244] on *R. ponticum* and hybrids; *Septoria azaleae* [ibid., x, p. 734], leaf and stem spots (*Pestalozzia macrotricha* and *P. rhododendri*) [ibid., ix, p. 389; x, p. 798], blights (*Phytophthora cactorum* [ibid., ix, p. 390] and *Botrytis* sp.), root rot (*Armillaria mellea*), bud blast (*Sporocybe azaleae*), and root rot and wilt (*P. cinnamomi*) [ibid., xi, pp. 356, 626] on various species; damping-off and basal canker (*Rhizoctonia*

[*Corticium*] *solani*) on *R. ponticum* and *R. carolineanum*; and slime mould (*Physarum cinereum*), causing the death of seedlings by suffocation.

BRIERLEY (P.). **Studies on mosaic and related diseases of Dahlia.** *Contrib. Boyce Thompson Inst.*, v, 2, pp. 235–288, 12 figs., 1 graph, 3 diags., 1933.

This is the full report of the author's investigation of mosaic and related diseases of dahlia, a brief abstract from which has already been noticed [*R.A.M.*, xii, p. 374]. In addition to the information previously given, it is stated that the term 'dahlia stunt' [ibid., x, p. 83] is not synonymous with mosaic, as it covers, besides some of the more pronounced mosaic symptoms in varieties less tolerant of this disease, also certain insect injuries. The severity of mosaic symptoms depends largely on the tolerance of the variety affected, ranging from simple veinbanding (the most constant and characteristic symptom) in the more tolerant varieties, to leaf distortions, shortening of the internodes and flower stalks, vein necrosis, and a tendency towards tuber stunting, in the more intolerant ones.

The infective principle of mosaic was shown to be present and to persist in all the vegetative parts of the affected plants, but not in the seed; its transmissibility by grafting but not by mechanical methods (all of which have proved so far to be ineffective) was demonstrated by experiments which also indicated that the various symptoms exhibited by tolerant and intolerant dahlia varieties are only varietal reactions to a single virus entity. Further experiments showed the aphid *Myzus persicae* to be a vector of mosaic, but gave no clear evidence that any of the other insects tested are implicated in its dissemination. While all of the members of the genus *Dahlia* so far tested are susceptible, no suscepts have been found outside this genus.

Limited field observations indicate that some infections through *M. persicae* take place in July, and that more occur in September and October. In the vicinity of New York the number of new infections in plots containing a considerable number of infected plants ranged from 10 to 25 per cent. per annum. The expression of the symptoms is often delayed in early season growth, and the chlorotic symptoms are frequently masked during the season, this effect being presumably determined by growth relations rather than by any single environmental factor. It is suggested that the disease may be controlled by selection and isolation of disease-free plants, supplemented by suppression of aphids in the greenhouse and roguing out of diseased plants. Tolerant, mosaic-infected varieties should be kept separate from healthy stocks.

The paper also includes some notes on three other virus diseases of dahlias, namely, ring spot, yellow ring spot, and oak-leaf [ibid., xii, p. 374]. Ring spot is generally distributed in Connecticut, New Jersey, and southern New York, although it was found in high percentages in only a few localities. It commonly accompanies mosaic and is characterized by irregular concentric rings, irregular zigzag markings, intricate hieroglyphic patterns, and green patterns, the colour of the chlorotic areas varying from pale

green to yellowish-green in different varieties. The symptoms may either disappear or become suppressed in subsequent years and partial infection of the vegetative parts appears to be not uncommon. This disease was experimentally transmitted by grafting but not by mechanical methods, and when *M. persicae* aphids were fed on plants exhibiting both ring spot and mosaic symptoms, the latter disease alone was transmitted by the insects to healthy plants. The bright yellow variety of this disease was seen for the first time in 1931 in Utah, and was also shown to be transmissible by grafting but not by mechanical means. The oak-leaf pattern is tentatively attributed to a virus solely on the basis of the symptoms expressed (in the varieties Calvin Coolidge, Jr., and Catherine Wilcox) since it was only recognized in 1932 and there has been little opportunity to test its transmission. Leaf-like markings and sometimes poorly defined large chlorotic rings appear on the leaves, but there is no dwarfing or necrosis.

None of these four virus diseases has so far been connected with any other known virus disease.

DIEHL (W. W.). **Exobasidium monosporum on Camellia.**—*Plant Disease Reporter*, xvii, 5, p. 44, 1933.

Leaves and twigs of *Camellia sasanqua* from Alabama were found to be seriously affected by a disease characterized by the development of a whitish bloom apparently due to *Exobasidium monosporum*, reported by Sawada as parasitic on *Gordonia* in Formosa (*Rept. Dept. Agric. Govt. Res. Inst. Formosa* 2, p. 108, 5 pl., 5 figs., 1922: Japanese). The fungus is characterized by the presence of only one spore on each basidium and is thus unique among the known American species of *Exobasidium*. *Camellia* has apparently not hitherto been recorded as a host of *E. monosporum*.

WILLIAMS (P. H.). **Leafy gall of the Chrysanthemum.**—*Eighteenth Ann. Rept. Cheshunt Exper. & Res. Stat., Hertfordshire, 1932*, pp. 32–39, 1933.

A condition known as 'leafy gall' which has affected chrysanthemums in the vicinity of Cheshunt for some years is stated recently to have become serious. Whereas in the healthy plant shoots are sent up from the base and are used for cuttings, in affected plants the shoots branch repeatedly, a thick mass of short shoots with small, distorted leaves being formed; sometimes the affected shoot instead of branching becomes thickened and bears fleshy leaves. The galls, most of which develop about December, soon die when the plants are cut down at the end of the season. Phyllis Cooper was the most susceptible variety, with 77·7 per cent. affected pots, Mary Morris showed 28·5 per cent., and Cheshunt White was the most resistant, with only 2·1 per cent. of infected pots.

Isolations of bacteria from affected material on Patel's bile salt agar [*R.A.M.*, vi, p. 19] were grown on numerous media and compared with others from a normal crown gall growing under soil level on a young chrysanthemum shoot, as well as with a pure culture of *Bacterium tumefaciens*; the morphological and physio-

logical characters [which are described] indicated that all were strains of *Bact. tumefaciens.* Pathogenicity tests resulted in the production of leafy galls in five out of 18 plants inoculated by pouring liquid cultures of the leafy gall strain on the soil, while stem inoculations by pricking caused slight swellings, unlike the definite galls produced by the other strains. Similar inoculations on stems of tomato, pelargonium, and *Tropaeolum* gave rise to more or less slight swellings with the leafy gall strain, which showed much less virulence than the other two.

Some preliminary experiments in the control of leafy gall by soil sterilization are briefly described.

BROWN (J. N.), SAVAGE (A.), & ROBINSON (A. D.). **A report of some investigations into the cause of Sweet Clover (Melilotus) disease.**—*Scient. Agric.*, xiii, 9, pp. 561–565, 1933. [French summary on p. 607.]

The results of experiments [details of which are given] with live cattle and rabbits showed that an intensive diet for 188 days of relatively mould-free sweet clover (*Melilotus*) [*alba*] did not cause in heifers any of the pathological symptoms associated with the serious disease, frequently ending in death, which is stated to be prevalent in Manitoba in cattle fed with sweet clover hay. No clinical symptoms ensued after 77 days' feeding of the heifers on sweet clover hay which was artificially inoculated with *Penicillium brevicaule* isolated from a lot of heavily moulded hay that had proved toxic to cattle on a Manitoba farm. The disease was reproduced, however, with lethal issue in one case, when four heifers were fed for 42 days on a relatively mould-free sweet clover hay (in which *P. brevicaule* was not found) which had also caused mortality in cattle, and which was of a dark brown colour and had a sweetish tobacco-like odour; these two characters seem to be typical of sweet clover possessed of disease-producing qualities. Tests with rabbits indicated that the toxic substance of such hay is not water-soluble, and the experiments do not support the prevalent opinion that only mould-damaged sweet clover causes the disease in question.

CROSBY (C. R.), MILLS (W. D.), & BLAUVELT (W. E.). **Protecting orchard crops from diseases and insects.**—*Cornell Agric. Exper. Stat. Bull.* 498, 82 pp., 18 figs., 1 diag., 1933.

This is a revision, stated to incorporate considerable additional information and practical suggestions, of the bulletin issued by the same writers in 1929 on the control of orchard diseases and pests by spraying and dusting in New York State [*R.A.M.*, ix, p. 459]. Schedules are given for the combined control of the chief insect pests and fungous diseases of each of the pome and stone fruits grown in the State, with special modifications when necessary to deal with severe attacks of the less common organisms.

ROSEN (H. R.). **Further studies on the overwintering and dissemination of the fireblight pathogen.**—*Arkansas Agric. Exper. Stat. Bull.* 283, 102 pp., 27 figs., 3 graphs, 1933.

The author gives considerable details of his continued researches

on the modes of overwintering and of dissemination in the spring in Arkansas of fireblight (*Erwinia amylovora*) [*Bacillus amylovorus*: *R.A.M.*, ix, p. 189]. Field observations and laboratory experiments showed that out of a grand total of some 60,000 infected apple and pear twigs and limbs examined from 1929 to 1932 in February, March, and April (i.e., prior to the appearance of new season infections in the field), not more than 25 bore bacterial ooze containing *B. amylovorus*; the ooze present on the remainder was either sterile or only contained saprophytic species of bacteria. A careful survey in the early spring of the three years revealed many instances in which no correlation could be established between the amount of the disease in a given year in the orchards, and the presence or absence of the trouble in them during the preceding season. In 1930, in particular, in many cases fireblight was found in considerable quantities in well-isolated orchards that were free from the disease in 1929 and which appeared to be out of reach of rain-driven inoculum. It was observed that while atmospheric precipitations in the early spring probably are at times an important factor in Arkansas in the distribution of *B. amylovorus*, in 1930, when blossom blight of apples was extremely prevalent and destructive, no rains fell throughout the blossoming period. This observation, together with other studies, lead the author to consider that in 1930, at least, pollinating insects and not rainfall were in a large measure responsible for the blossom blight, this view being supported by the fact that in studying the sequence in the development of fireblight within any one season, blossoms of both pears and apples were found to be the first organs to show signs of infections.

Artificial inoculations both in the field and in the greenhouse showed that, at the time of blossom production, the young leaves whether in the blossom cluster or arising from vegetative buds are fully as susceptible to infection as the floral tissues, and that infections on flowers and leaves are readily obtainable in the absence of wounds or of insects, provided the inoculum is applied as a water spray simulating ordinary precipitation or rain driven by wind. When the earliest symptoms of infection were not complicated by frost injury, fireblight usually appeared in the upper parts of the flowers, suggesting distribution of the parasite by blossom-visiting agents, but when frosts cause the early flowers to fall the disease appears simultaneously on blossoms and leafy shoots.

A study of twig blight of pears and apples indicated that while much of it is secondary and is directly or indirectly connected with blossom blight, there is a second type of primary nature, which may originate in four different ways: (*a*) as internal extensions of the previous year's lesions, usually appearing shortly after the first symptoms of blossom blight; (*b*) as bud infections in which the buds, though infected the previous year by internal extension, remain alive through the winter; (*c*) as infections resulting from bacterial exudates produced in the previous season; and (*d*) as twig blight caused by inoculum from overwintered cankers, a form which does not ordinarily appear in Arkansas until late May or June. Evidence was also obtained that under natural conditions twig blight originates mainly from direct in-

fections on the stems rather than through leaves, entrance apparently being effected in some instances through the stomata, often through those located in the axils of the leaves. There were indications, however, that mechanical wounds are even more important than the stomata as ports of entry for the organism.

Considerable details are also given of the investigations concerning the distribution of fireblight by honey bees and other insects, confirming the oversummering and overwintering of the pathogen in some beehives [ibid., x, p. 111], and the paper terminates with a discussion of preliminary experiments on the control of the blossom blight stage of the disease, a brief report of which has already been noticed from another source [ibid., xii, p. 225].

MIX (A. J.). **Factors affecting the sporulation of Phyllosticta solitaria in artificial culture.**—*Phytopath.*, xxiii, 6, pp. 503–524, 1 fig., 1933.

In the writer's laboratory studies at Kansas University, the apple blotch fungus (*Phyllosticta solitaria*) produced pycnidia and spores [*R.A.M.*, xi, p. 583] on a variety of media, especially potato-dextrose and apple bark decoction agar, the former at one-tenth the usual strength and the latter at one-fifth. No effect is exercised on the sporulation of *P. solitaria* in culture by light or darkness, the locality of origin of the fungus, the portion of the host from which it is isolated, or the time of year when the cultures are made. A modified Coons's medium has also given good results, the composition being as follows: 0·5 gm. $KNO_3$, 1·25 gm. $KH_2PO_4$, 0·75 gm. $MgSO_4$, 0·10 gm. dextrose, 20 gm. agar, and 1,000 c.c. water. The best source of nitrogen was found to be potassium nitrate, followed by albumen, while asparagin and peptone were less favourable. Dextrose, levulose, mannose, and sucrose were equally valuable as sources of carbon.

On the modified Coons's medium the fungus produced fertile pycnidia at an initial hydrogen-ion range from $P_H$ 4·2 to 5·8. The minimum, optimum, and maximum temperatures for growth in culture were from 8° to 12°, 26° to 29°, and 33° to 35° C., respectively, and for sporulation the optimum ranged from 22° to 29°.

Non-sporulating strains of *P. solitaria* were isolated in some cases and also arose from the sporulating strains by mutation. Autolysis of the mycelium and spores occurs in old cultures (upwards of a fortnight).

MCLARTY (H. R.). **Perennial canker of Apple trees.**—*Canadian Journ. of Res.*, viii, 5, pp. 492–507, 2 pl., 1 fig., 1933.

Further studies on the perennial canker of apple trees (*Gloeosporium perennans*) in the Okanagan district of British Columbia [*R.A.M.*, xi, p. 248; xii, p. 299] have indicated that the association of three factors is necessary to induce the occurrence of the disease, namely, infection of the tissues by the fungus; annual late summer and autumn invasion of the callus tissue by the woolly aphis (*Schizoneura* [*Eriosoma*] *lanigera*); and the exposure of the trees to periods of low temperatures during the winter. Various other influences further the development of perennial canker, including heavy precipitation, early pruning (in November or December),

and the cultivation of susceptible varieties, such as Spitzenberg, Yellow Newtown, Rome Beauty, and Jonathan.

Discussing separately each of the three primary factors in the causation of perennial canker, the writer emphasizes the importance of the saprophytic phase in the life-cycle of the fungus, which ensures its perpetuation quite independently of parasitic action; the latter, in fact, is definitely limited to one season under natural conditions, though artificial inoculations of the xylem are successful at almost any time. The fungus is incapable by itself of reviving old infections, and it further seems clear that no new infection can arise in the canker from the germination of spores on the surface of the callus. Canker formation, therefore, is dependent on a series of successive inoculations into the callus tissue, a process readily effected during the late summer and autumn through the feeding activities of the woolly aphids. In a protracted experiment conducted in two districts on two varieties, involving the treatment of over 400 cankers, no case of new infection was observed in any canker from which the insects were excluded, whereas in all except two of those harbouring aphids fresh infection took place. The host tissues are brought into a suitable physiological condition for invasion by *G. perennans* by lengthy exposure to low temperatures, resulting in the subsequent enlargement of the cankers in the late winter and early spring. In the absence of any one of these three factors perennial canker fails to develop.

From an economic standpoint the present control measures against perennial canker are scarcely satisfactory, the removal of dead bark from the cankers being a tedious operation and the cost of aphid eradication prohibitive.

KATSER (ANNIE). **Ueber die Resistenz verschiedener Apfelsorten gegenüber Sclerotinia fructigena (Pers.) Schroet. und ihre Beziehung zur Wasserstoffionenkonzentration.** [On the resistance of different Apple varieties to *Sclerotinia fructigena* (Pers.) Schroet. and its relation to the hydrogen-ion concentration.]—*Phytopath. Zeitschr.*, vi, 2, pp. 177–227, 8 figs., 2 diags., 1933.

A comprehensive account, supplemented by tables, is given of the writer's investigations on the varietal reaction of apples to infection by *Sclerotinia fructigena* in Austria.

Even in varieties showing resistance to brown rot in nature, inoculation after wounding the skin produced infection, thereby indicating the importance of the skin as a protection against the fungus. A decisive influence on infection by *S. fructigena* is exerted by the prevailing temperature, a marked retardation following a fall below the optimum for the growth of the organism, namely, 22° to 25° C. Varietal reaction is affected by a number of internal and external factors, the latter including habitat and climatic conditions, so that hard-and-fast standards of resistance and susceptibility are not generally applicable. However, the Jonathan, Grüner Fürsten, and Rote Jungfer varieties proved uniformly resistant, even under conditions favouring the fungus, while Kaiser Alexander and others were consistently susceptible.

At a stage of ripening when apples inoculated in the laboratory

were most extensively invaded by *S. fructigena*, there were still no symptoms in the open, whereas in parallel tests on apricots with *S. laxa* [*S. cinerea*], the results of field observations and laboratory tests were in agreement.

Apples of a given variety showing greater resistance to *S. fructigena* than other representatives of the same variety were found to have a higher hydrogen-ion concentration. During the process of rotting the hydrogen-ion concentration of the fruit was found to rise.

In artificial inoculation experiments the grey or yellow colour of the conidial cushions cannot be used as evidence of the identity of the fungus, since both occur indifferently in infections by *S. fructigena*. A concentric arrangement was observed only on the Kaiser Alexander and Charlamowsky varieties; on all others the conidia were scattered irregularly over the surface. Conidial formation takes place in darkness as well as in the light. *S. fructigena* appears to secrete toxins producing a staling effect on the medium.

**Apples in cold storage.**—*Fruit World of Australasia*, xxxiv, 6, p. 329, 1933.

In a test carried out in New South Wales, Granny Smith apples were enclosed in sulphite papers and embedded in wood wool, an equal number of cases being similarly wrapped but embedded in peat moss. After six months' cool storage the fruit packed in the peat moss was much less affected by scald and blue mould [*Penicillium expansum* and other species: *R.A.M.*, xi, p. 659] than that packed in the wood wool, but even the former showed nearly 20 per cent. scald. In another test scald was reduced to about 2 per cent. by wrapping the apples in oiled papers.

**Brown rot of stone fruits.**—*Fruit World of Australasia*, xxxiv, 6, pp. 335–336, 1933.

It is thought that brown rot of apricots and peaches in Victoria (*Sclerotinia cinerea*) [*S. americana*: *R.A.M.*, viii, p. 386; ix, p. 464] may be considerably reduced by removing and burning all dead twigs or those bearing diseased fruits, and spraying after pruning with Bordeaux mixture 12–5–80 plus 1·5 gall. of a winter white oil, this application being repeated about 1st August, before the buds break.

TURNER (W. F.). **Progress in phony Peach disease eradication.**—*Journ. Econ. Entom.*, xxvi, 3, pp. 659–667, 1 diag., 2 maps, 1933.

An account is given of the present situation regarding the distribution and eradication of the phony peach disease [*R.A.M.*, xii, p. 575] in the United States. Between 1929 and 1932, 33,876,304 trees in 8,557 orchards were inspected, of which 370,312 trees in 3,173 orchards were destroyed on account of the disease, which now occurs in 13 States. At the third inspection of lightly infected territory in North Georgia (289 orchards containing 629,413 trees) a reduction of 84·10 per cent. in the number of infections was observed, the corresponding figure for the second

inspection of a heavily infected area (Fort Valley Plateau) comprising 127 orchards with 911,550 trees being 66·74 per cent.—results considered to be decidedly encouraging.

THOMAS (H. E.). **The Quince-rust disease caused by Gymnosporangium germinale.**—*Phytopath.*, xxiii, 6, pp. 546–553, 1 fig., 1933.

The following species of *Crataegus*, not included in previous lists, have been found susceptible to infection by quince rust (*Gymnosporangium germinale*) [*R.A.M.*, xii, p. 452] in central New York: *C. arnoldiana*, *C. beata*, *C. brainerdi*, *C. calpodendron* [*C. tomentosa*], *C. filipes*, *C. holmesiana*, and *C. monogyna* [*C. oxyacantha*]. On some species the larger stems may be infected and prominent swellings and cankers produced. Individual red cedar [*Juniperus virginiana*] trees show marked variations in susceptibility to *G. germinale*, while those readily infected by this rust may be resistant to the apple and hawthorn rusts (*G. juniperi-virginianae* and *G. globosum*, respectively).

The sporidia may be discharged within 2½ hours after moistening the teleutosori with water, and may begin to germinate within 2 hours after immersion in water. Viable aecidiospores are occasionally found in nature as late as April (at Ithaca) but only in deep-seated aecidia from which dissemination would be difficult. The aecidiospores germinate well at 15° to 18° C. without a preliminary rest period.

The symptoms develop five to eight days after inoculation of the leaves of susceptible *Crataegus* plants with germinating teleutospores, whereas on the more resistant apple foliage they were not observed for 10 to 18 days.

KOCH (L. W.). **Investigations on black knot of Plums and Cherries. I. Development and discharge of spores and experiments in control.**—*Scient. Agric.*, xiii, 9, pp. 576–590, 3 figs., 2 graphs, 1933. [French summary on p. 608.]

After a brief reference to the economic importance of the black knot disease (*Dibotryon morbosum*) of plums and cherries in Canada [*R.A.M.*, x, p. 392], where the disease is stated to have been unusually prevalent in 1928 and 1929, the author gives details of his preliminary investigation of the conditions governing the discharge of the spores of the fungus in the field and laboratory. During the period 1929 to 1933 the date of the first discharge of ascospores observed on *Prunus domestica* in the Niagara peninsula varied from 23rd March to 6th April, after which discharges continued to occur periodically until the end of the first week in June, while perithecia collected on *P. pennsylvanica* discharged their spores as early as 20th November in 1931 under laboratory conditions. In the orchard, rainfall appeared to be the predominating factor determining ascospore discharge, but did not seem to have any bearing on the abundance of the discharge, the latter being apparently governed by temperature, with a minimum below 40° F. and a maximum at temperatures ranging between 50° and 80° in the laboratory. The amount of spores discharged also appeared

to be governed by the degree of maturity of the perithecia. At the time when ascospore discharge ceased, conidia of *D. morbosum* were found in abundance on knots on *P. domestica*, and they continued to be produced throughout the summer. Wind was shown to be an important factor in the dissemination of the ascospores and of the conidia, the latter being apparently also disseminated by atmospheric water.

Preliminary control experiments in an orchard of Lombard plum trees gave a good illustration of the importance of control measures, since in a block of trees that were neither pruned nor sprayed the number of knots increased by 1,655 per cent. within three years, while over 95 per cent. control was obtained in a block that was adequately pruned and sprayed. The spraying schedule which gave the best control was a delayed-dormant spray of either 3 per cent. oil emulsion Bordeaux mixture or 1 in 8 lime-sulphur at about the time the buds were opening, followed by a second application of 1 in 40 lime-sulphur when the shucks [? calyces] were falling, and a third of the same strength some weeks later. Knots on large limbs and trunks were successfully removed by surgical methods.

HUS (P.). **Ziekten en beschadigingen van klein fruit (Bessen, Frambozen, Aardbeien).** [Diseases and injuries of small fruit (Currants, Raspberries, Strawberries).]—*Tijdschr. over Plantenziekten*, xxxix, 6, pp. 121–161, 6 pl., 1933.

Notes are given in semi-popular terms on the symptoms, causes, and control of the following diseases of small fruit in Holland: parsley leaf, nettlehead, or reversion of black currants [*R.A.M.*, viii, p. 44; ix, p. 394]; *Verticillium dahliae* on the same host [ibid., iv, p. 495], this fungus being also held responsible for the so-called 'oedema' and for the sudden wilting and rupture of the cortex ('Bangert' disease) of red and white currants [cf. ibid., iii, p. 317], which are further liable to infection by *Gloeosporium* [*Pseudopeziza*] *ribis* and *Stereum purpureum*, besides suffering from leaf scorch [ibid., xii, p. 302]. Gooseberries are attacked by mildew (*Sphaerotheca mors-uvae*) and a species of *Botrytis* causing die-back of the shoots [cf. ibid., iii, p. 525; iv, p. 44].

Raspberries are affected by a group of viruses collectively designated for the present as mosaic [ibid., viii, p. 44], while the pathogenic fungi described on this host include *Coniothyrium fuckelii* [*Leptosphaeria coniothyrium*: ibid., vi, p. 739], *Fusarium* sp., *Plectodiscella veneta, Didymella applanata, Hendersonia rubi* [ibid., ix, p. 117], and *V. dahliae* [ibid., xi, p. 61]. Crown gall (*Bacterium tumefaciens*) [ibid., xi, p. 428] has also been observed.

The diseases of strawberries include mosaic, mildew (*S. humuli*) [ibid., x, pp. 248, 254], and leaf spots caused by *Mycosphaerella fragariae* (the conidial and pycnidial stages of which are *Ramularia tulasnei* and *Ascochyta fragariae*, respectively) [ibid., x, p. 584; xi, p. 463], and *Fabraea fragariae* (*Marssonia* [*Marssonina*] *fragariae*) [ibid., iii, p. 663].

[This paper is also published as *Versl. en Meded. Plantenziektenkundigen Dienst te Wageningen*, 70, 41 pp., 6 pl., 1933.]

STEVENS (N. E.). **Strawberry diseases.**—*U.S. Dept. of Agric. Farmers' Bull.* 1458, 17 pp., 9 figs., 1 diag., 1933.

This is a revision of the bulletin issued under the same name in 1925 [*R.A.M.*, v, p. 41].

**Orange rust of Blackberry and Raspberry.**—*New Jersey Agric. Exper. Stat. Circ.* 282, 2 pp., 1933.

A popular note is given on the symptoms, life-history, and control of the orange rust of blackberry and raspberry (*Gymnoconia interstitialis*) [*R.A.M.*, x, pp. 116, 164] in New Jersey.

BECKWITH (C. S.). **Cranberry false blossom.**—*New Jersey Agric. Exper. Stat. Circ.* 275, 4 pp., 4 figs., 1933.

A popular description is given of the false blossom disease of cranberries, which is stated to be assuming a very serious form in New Jersey, with directions for flooding and spraying the bogs to eliminate the insect carrier, the blunt-nosed leafhopper (*Euscelis striatulus*) [*R.A.M.*, x, p. 739].

SCHWARZ (O.). **Die Zweigdürre des Oelbaumes, verursacht durch Hysterographium oleae n. sp., eine bisher unbeachtet gebliebene Pflanzenkrankheit des östlichen Mittelmeergebietes.** [The withering of Olive twigs caused by *Hysterographium oleae* n. sp., a hitherto unnoticed plant disease of the eastern Mediterranean region.]—*Phytopath. Zeitschr.*, vi, 1, pp. 103–110, 1 fig., 1933.

A description is given of an olive disease occurring in the west and south-east of Turkey and associated with a *Hysterographium*. The first symptom of the disease on the green, leafy, one- to two-year-old twigs is the appearance of ill-defined grey to blackish spots with a brownish border, which may almost girdle the twig. They usually start at a node and extend downwards to a second or third, attaining a length of 3 to 8 cm. and a width of 5 to 25 mm. During the spring the leaves of the affected twigs turn yellow and fall, as also do any fruits that may be present. No case of renewed growth has been observed, and by the beginning of July the twigs are nearly black and quite desiccated. In July or August scattered fissures, 0·6 to 1·8 by 0·3 to 0·7 mm., develop and in these the apothecia, which measure 0·5 to 1·5 by 0·2 to 0·8 mm. when ripe, appear. The apothecia persist on the twigs apparently for a period of years. Owing to the scattered nature of the infection amid the healthy foliage of the crown, the disease has long remained unrecognized.

The lesions on green twigs show a brown discoloration of the cambial cells and a shrivelling of the walls which are often permeated by inter- and intracellular hyphae. Eventually the disorganized cells collapse completely and become embedded in a flat stroma, 1 to 2 by 0·3 to 1 mm., on which the apothecia develop. The fungus resembles *H. fraxini* but the ascospores were somewhat smaller (26 to 32 by 10 to 14 $\mu$, as compared with 36 to 40 by 15 to 20 $\mu$). Neither this fact nor the divergent symptoms of the disease on a new host would justify the establishment of a new

species, but this step is thought to be warranted by the apparent absence of a conidial form in the life-cycle of the olive pathogen, which is accordingly named *H. oleae* O. Schw. [No mention is made of *H. fraxini* var. *oleastri* Desm. recorded on the same host, of which specimens were received at the Imperial Mycological Institute in February, 1933, on olive twigs from Bornova, Turkey.]

Positive results in inoculation experiments were given only where the infective material was applied to severely wounded surfaces. The wild suckers of an *Oleaster* stock, on which an olive was grafted, also contracted infection by this method, although the former is not susceptible in nature.

It is difficult to form an exact estimate of the damage caused by *H. oleae* owing to the irregular character of the infection, but in Bergama district the losses were roughly calculated at 10 to 30 per cent. of the crop in October, 1931, while in August, 1932, the proportion of dead twigs at Bademye was reckoned to reach 50 per cent. The only practicable line of control seems to consist in the thorough cleansing of the plantations during the spring, all dead and dying twigs being cut out and burnt to prevent the survival of the apothecia.

RICCARDO (S.). **Secondo contributo allo studio di una malattia che danneggia le Olive in Calabria: Macrophoma dalmatica —Thüm.—Berl. et Vogl.** [A second contribution to the study of a disease injuring Olives in Calabria: *Macrophoma dalmatica* (Thüm.) Berl. et Vogl.]—*Ann. R. Ist. Sup. Agrar. di Portici*, Ser. III, vi, pp. 209–216, 3 pl., 2 figs., 1933. [Abs. in *Riv. Pat. Veg.*, xxiii, 3–4, pp. 190–191, 1933.]

The fungus previously reported as associated with a fruit spot of olives in Calabria [*R.A.M.*, x, p. 607] has now been identified as *Macrophoma dalmatica* [ibid., vi, p. 395; vii, p. 491]. A few pycnidial fructifications were found on the branches, though the leaves appeared to be unaffected. The fungus was found on fruits free from any sign of insect attack.

CARNEIRO (J. G.). **Algumas doenças mais graves do Abacateiro.** [Some of the most serious Avocado diseases.]—*Rev. Soc. Rural Brasil.*, xiii, 154, pp. 282–284, 2 figs., 1933.

The symptoms of the principal avocado [*Persea gratissima*] diseases in Brazil are briefly described in popular terms, with directions for their control. They include anthracnose caused by *Glomerella cingulata* [*R.A.M.*, viii, pp. 291, 727], mildew (*Oidium* sp.) [ibid., iv, p. 722], verrucosis (*Sphaceloma* sp.) [ibid., xi, p. 625], and fruit rots due to *Fusarium*, *Pestalozzia*, *Cladosporium*, and *Hendersonia* spp., *Diplodia natalensis* [ibid., v, p. 506], and *D.* [*Botryodiplodia*] *theobromae*. The treatments recommended are as follows: against anthracnose and verrucosis, spraying with Bordeaux mixture or a solution of Caffaro powder at the strength of 1 kg. to 100 l. water [see above, p. 683], and against mildew dusting with flowers of sulphur. These measures are only partially effective against the rots, the control of which necessitates careful picking.

CATHCART (C. S.) & WILLIS (R. L.). **Analyses of materials sold as insecticides and fungicides during 1932.**—*New Jersey Agric. Exper. Stat. Bull.* 548, 15 pp., 1932. [Received August, 1933.]

The following data were obtained from the analysis of fungicides submitted for examination by a number of commercial firms in 1932 [cf. *R.A.M.*, ix, p. 325]. Acme Bordeaux mixture—dry powdered form (Acme White Lead and Colour Works, Detroit, Michigan), contained 12·98 per cent. metallic copper (12·75 per cent. guaranteed); Bowker's dry powdered Bordeaux mixture, 12·94 (13); Key Brand special Bordeaux mixture powder, 25·66 (22); Green Cross Cloros Dry Bordo 9 per cent., 10·34 (9); Mechling's Bordeaux mixture powder, 13·23 (12·75); Fungi-Bordo (Sherwin-Williams Co., Cleveland, Ohio), 11·80 (12·75).

Mechling's superfine dusting sulphur contained 99·45 per cent. sulphur; Jersey dry-mix (Ansbacher-Siegle Corp., New York), 64·26; two brands of Koppers' flotation sulphur, 38·56 and 38·47 (35), respectively, and three brands of dry-wettable flotation sulphur [ibid., xii, p. 577], 87·83, 84·36, and 86·02 (80), respectively; 80–20 sulphur-lime dust and two brands of sulpho-tone (Lucas Kil-Tone Co.), 76·31 (80), 60·55 (60), and 61 (60), respectively; Mechling's dry-mix and superfine 80–20 dusting mixture, 63·66 (60) and 80·33 (77), respectively; Niagara dry-mix, the same Company's 80–20 sulphur-lime mixture, two brands each of kolofog and koloform, and kolodust [see above, p. 673], 63·21 (61), 76 (77), 37·48 (30), 38·88 (30), 68·05 (54), 65·34 (54), and 91·67 (90), respectively.

Bowker's concentrated lime-sulphur (solution) contained 25·01 per cent. total sulphur; G.L.F. lime-sulphur solution (Co-operative G. L. F. Mills, Inc., Buffalo, N.Y.), 25·78; two Orchard Brand lime-sulphur solutions (General Chem. Co., New York), 25·19 and 25·07, respectively; Mechling's concentrated lime-sulphur solution, 23·35; and Niagara lime-sulphur solution, 24·90.

Acme lime-sulphur, dry powdered form, contained 62·41 per cent. total sulphur; Bowker's dry lime-sulphur, 62·23; Key Brand dry lime-sulphur, 63·17; Mechling's dry lime-sulphur, 62·31; Niagara dry lime-sulphur, 62·70; and Sherwin Williams dry lime-sulphur, 62·28.

The figures for a number of miscellaneous brands are also given.

GRAHAM (J. J. T.). **Report on insecticides and fungicides.**—*Journ. Assoc. Official Agric. Chemists*, Washington, xvi, 2, pp. 151–152, 1933.

Further studies were made of two methods for the analysis of Bordeaux-lead arsenate mixture [*R.A.M.*, xi, p. 663], two samples being selected for collaborative investigation, (1) containing 22·35 per cent. lead oxide and 12·53 per cent. copper, and (2) 17·60 per cent. lead oxide and 14·45 per cent. copper. The results [which are tabulated] of the analyses were very satisfactory. There is little choice between the two methods [one of which appears to be similar to Bubb's: ibid., x, p. 807], but the second, an electrolytic method devised by C. G. Donovan, is somewhat quicker and more uniform. It is recommended that the latter be adopted as official (first action) and further studied.

LACORTE (C. G.). **Estudio sobre el sulfuro de calcio.** [A study on lime-sulphur.]—*Bol. Mens. Min. Agric. Nac.*, Buenos Aires, xxxii, 3, pp. 455–464, 1933.

A general account is given of the constituents, technique of testing, preparation, and manufacture of lime-sulphur in the Argentine, together with the methods of analysis according to the requirements of the Association of Official Agricultural Chemists (U.S.A.) [see preceding abstract].

GOLDSWORTHY (M. C.) & GREEN (E. L.). **Some promising fungicides.**—*Phytopath.*, xxiii, 6, pp. 561–562, 1933.

Promising results in the control of scab (*Venturia inaequalis*) and bitter rot (*Glomerella cingulata*) of apple, brown rot (*Sclerotinia fructicola*) [*R.A.M.*, xii, p. 228] and scab (*Cladosporium carpophilum*) of peach, and pecan scab (*C. effusum*) [ibid., xi, p. 213], have been obtained in laboratory trials at the Arlington Farm, Virginia, by copper oxide, copper silicate, and copper phosphate, ground sufficiently fine to pass through a 300-mesh screen, or to the standard of Portland cement, and combined with bentonite [ibid., x, p. 533] flocculated by lime. None of the compounds injured the York and Grimes apples used in the field tests, but copper phosphate caused some damage (though less than Bordeaux mixture) to Hiley peaches. Infection was practically absent in the orchard, so that no judgement could be formed respecting the efficacy of the fungicides on a large scale. It was ascertained, however, by placing spores of the test fungi on slides hung among the leaves of the host and sprayed with the tree, that the materials exert their toxicity under orchard conditions for at least ten days (21 in the case of copper phosphate). The following formula was used: copper silicate, oxide, or phosphate 2 lb., hydrated lime or equivalent CaO 4 lb., bentonite 2 lb., a standard insecticide 1 lb., and water 50 galls. The same amounts of copper and lime, mixed with 4 lb. bentonite and 1 lb. insecticide, produce a dust with good physical properties.

JØRGENSEN (C. A.). **Afprøvning af Jorddesinfektionsmidler.** [Tests of soil disinfectants.]—*Tidsskr. for Planteavl*, xxxix, 2, pp. 316–328, 1 fig., 1933.

Details are given of a series of experiments carried out at the State Phytopathological Experiment Station, Lyngby, Denmark, during 1931–2 on a number of soil disinfectants for their efficacy against *Rhizoctonia* [*Corticium*] *solani* on cucumbers, *Pythium de Baryanum* on cauliflower, and *Plasmodiophora brassicae* on swedes.

*Pythium de Baryanum* was completely controlled by carbololie [oil] I and II (M. Jensen, Svendborg Carton and Cement Factory), at the rate of ¼ to ½ kg. per sq. m. in 15 l. water, four weeks before planting; germisan (two applications of a 0·125 per cent. solution with a ten-day interval, at the rate of 6 to 8 l. per sq. m.); kerol (Cooper, McDougall & Robertson, Ltd., England) [*R.A.M.*, xii, p. 420], applied at the rate of 1 l. in 400 l. water per sq. m. three weeks before planting; Koefoed-Johnsen's (Copenhagen) soil sterilizer (1 kg. per sq. m.); pure carbolic acid, 250 gm. per sq. m. in 10 l. water, applied four weeks before planting; formalin (same

rate, three weeks before planting); and heating in a stove for two to three hours at 90° to 95° C. Some degree of control was also given by several other substances.

Excellent control of *C. solani* was obtained by one or two applications of 75 gm. uspulun per sq. m. dissolved in water; mercuric chloride + saltpetre (3 to 5 gm. of the former and 30 gm. of the latter in 6 l. water per sq. m., a week before planting); and heating the soil as against *P. de Baryanum.*

Pure carbolic acid, formalin, uspulun, and sterilization by heat entirely eliminated *Plasmodiophora brassicae*, against which some of the other substances were moderately effective.

Generally speaking, these results indicate no superiority for the patent preparations as compared with pure chemicals or the far more widely applicable method of sterilization by heat.

McCallan (S. E. A.) & Wilcoxon (F.). **The form of the toxicity surface for copper sulphate and for sulphur, in relation to conidia of Sclerotinia americana.**—*Contrib. Boyce Thompson Inst.*, v, 2, pp. 173–180, 3 graphs, 1933.

In a brief introduction the authors show that the data obtained from the various types of curves encountered in toxicity studies of various substances [*R.A.M.*, xi, p. 730] may be plotted on the surface of a solid model (constructed for each particular substance) in which the three co-ordinates are time, concentration of the toxic agent, and percentage number of similar organisms exhibiting a certain response to the substance. By way of illustration, two such 'toxicity surfaces' are figured, which were determined for the germination of conidia of *Sclerotinia americana* in the presence of copper sulphate (soluble toxic agent) and of sulphur dust (insoluble agent), respectively.

The evidence obtained during this work indicated that the accuracy of toxicity tests [loc. cit.] depends not only on the number of organisms (spores) used, but also on the form of the toxicity surface, and that a knowledge of the latter makes it possible to determine in what region to work in order to obtain the greatest precision. High precision is unobtainable if the percentage germination is very high or very low, the point of minimum error varying in dependence on the form of the toxicity surface. It was further shown that toxic substances may be compared as conveniently on the basis of the time periods required for an equal percentage response as on the basis of the percentages responding in equal times, since both methods are capable of equal precision at a given point of the toxicity surface.

Ribereau-Gayon (J.). **Sur la solubilité des composés cuivriques des bouillies anti-cryptogamiques.** [On the solubility of the copper compounds of anti-cryptogamic mixtures.]—*Comptes rendus Acad. des Sciences*, cxcvii, 3, pp. 267–268, 1933.

It was ascertained by the electrometrical method that the concentration of copper ions in Burgundy mixture is a thousand times higher than in Bordeaux mixture, a fact that may well account for the scorching of the young foliage by the former preparation. In the writer's experiments the behaviour of the so-called 'inverted

Bordeaux mixture' (obtained by pouring copper sulphate into lime) was exactly the same as in the ordinary reverse procedure, so that any difference in the efficacy of the two preparations cannot be attributed to variations in the solubility of the components.

MAUME (L.) & BOUAT (A.). **Zones de stabilité en fonction du $P_H$ des divers composés cupriques d'une bouillie bourguignonne.** [Zones of $P_H$ stability of the various copper components of a Burgundy mixture.]—*Comptes rendus Acad. des Sciences*, cxcvi, 26, pp. 2024–2026, 1933.

A fully detailed and tabulated account is given of the writers' experiments, conducted by the micro-electrolytic and volumetric methods, to determine the relation of the reaction of the medium to the precipitation of the various copper components of Burgundy mixture [cf. *R.A.M.*, iv, p. 298; vii, p. 552; x, p. 156]. The chemical composition of the mixture was found to depend very closely on the $P_H$ of the medium, each insoluble copper component being able to exist only between certain narrow limits of acidity.

GINSBURG (J. M.). **Compatibility of oil emulsion-cresylic acid sprays with fungicides.**—*Journ. Econ. Entom.*, xxvi, 3, pp. 566–571, 1933.

Laboratory tests with oil emulsion-cresylic acid spray mixtures were conducted with a view to improving their stability on amalgamation with fungicides such as Bordeaux mixture and lime-sulphur. Subsequently field trials were carried out on five blocks of apple trees of the Grimes, Stayman, Wealthy, and Paragon varieties at the New Jersey Agricultural Experiment Station with five selected spray mixtures, in order to ascertain whether the addition of fungicides to an oil-cresylic spray impairs its toxicity to aphis or red mite [*Paratetranychus pilosus*]. Freshly made 4–6–50 Bordeaux produced a stable mixture with 3 per cent. oil emulsions containing 0·5 per cent. cresylic acid. Lime-sulphur (1 in 9 or 1 in 40) alone was not compatible with oil emulsions containing cresylic acid, but with the addition of 3 lb. skim milk and the use of 0·5 per cent. of a colloidal cresylic acid (prepared by adding 20 per cent. soap to the ordinary 95 per cent. cresylic acid) per 100 galls. a mixture of stable consistency was obtained. Neither Bordeaux mixture nor lime-sulphur caused any decrease in the toxicity of the oil-cresylic sprays to the insect eggs, and the use of combined preparations of this type is recommended as a practical and economical means for the joint control of apple pests and diseases.

HEIM (R.) & LAMI (R.). **La maladie bactérienne des Zostères: extension et causes favorisantes.** [The bacterial disease of the *Zosterae*: distribution and predisposing factors.]—*Comptes rendus Acad. d'Agric. de France*, xix, 20, pp. 738–742, 1933.

So disquieting were the reports from various coastal districts in France on the extent and severity of the bacterial disease of the grass-wrack seaweed (*Zostera marina*), first observed during the winter of 1931–2 [*R.A.M.*, xii, p. 308], that the responsible government departments recently undertook a scientific investigation of the problem. The results of this inquiry have shown that the

grass-wrack is destroyed along the greater part of the Cotentin and Brittany coasts, round Saint-Nazaire, in the Arcachon basin, and in a lesser degree also in the Vendée and Charente. Information from the Mediterranean regions is less reliable owing to the common confusion of *Z. marina*, not only with the seemingly immune *Z. nana*, but also with the other Potamogetonaceae, *Cymodocea nodosa* [*C. aequora*] and *Posidonia caulini*. However, the bacterial disease appears to have caused damage in a number of fishponds and along the coast between Martigues and the Italian frontier, while it is also reported from the coasts of Holland, Portugal, the south of England, [Canada, and the United States: ibid., xii, p. 646].

Among the factors probably predisposing the grass-wrack to bacterial invasion may be mentioned the very severe frosts of the winter of 1931–2; mechanical injury by drag-nets, dredging machines, and the like, as well as by epiphytic algae; and water pollution by factory residues or the copper sulphate from vineyards. None of these causes, however, can be more than contributory to the primary action of the bacteria. Spontaneous recovery from the disease appears to have occurred in some places.

Not only are the local uses of the grass-wrack seaweed (manure, packing, stuffing, and so forth) affected by the new disease, but a number of fish and molluscs are disappearing from the regions under observation.

Henry (L. K.). **Mycorhizas of trees and shrubs.**—*Bot. Gaz.*, xciv, 4, pp. 791–800, 6 figs., 1933.

Mycorrhiza of three types, ectotrophic, endotrophic, and ectendotrophic, have been detected on 60 different trees and shrubs in Butler County, Pennsylvania, 26 of which are stated to be new additions to the list of mycorrhizal host plants. Lists are given of the species involved, showing the type of mycorrhiza in each case, while the salient features of the symbionts are presented in tabular form.

Knudson (L.). **Non-symbiotic development of seedlings of Calluna vulgaris.**—*New Phytologist*, xxxii, 2, pp. 115–127, 2 pl., 1933.

Further experiments are reported in detail substantiating the writer's former contention that sterile seedlings of *Calluna vulgaris* develop roots on various culture media with or without sugar and without the intervention of any fungus [*R.A.M.*, ix, p. 398]. Some of the seeds germinated in a few days and it was possible to maintain them in tube culture for several months. Well-developed seedlings were placed in tubes containing potato-dextrose agar and incubated for eight months, at the end of which no fungi were found in or on the plants or in the medium. Microscopic examination of the roots failed to show the presence of any fungi or other organisms. Both potato- and peptone-dextrose agar were found to be toxic to *Calluna* roots, the latter being probably responsible for the stubby condition observed by Dr. Rayner in her asymbiotically germinated seedlings. The author has been unable to find

any evidence of the necessity of *Phoma radicis callunae* to proper root development in *C. vulgaris*.

MIRIMANOFF. **Sur la castration parasitaire chez Anemone ranunculoides L.** [On parasitic castration in *Anemone ranunculoides* L.]—*Bull. Soc. Bot. de Genève*, Sér. 2, xxiv (*1931–2*), pp. 264–265, 1933.

A plant of *Anemone ranunculoides* attacked by *Puccinia pruni-spinosae* [*R.A.M.*, xii, p. 451] at Onex, Switzerland, showed hypertrophy of the stem, extensive involvement of the lower surface of the involucrum, the presence of aecidia and spermogonia in the petals, and a reduction in the size of the latter on the terminal flower, as well as of the carpels, the stamens and pollen grains remaining normal. The floral modifications caused by the fungus in this case did not result in parasitic castration of the type described by A. Magnin on the same host infected by *Aecidium leucospermum* and *A. punctatum* (*Bull. sci. Fr. Belg.*, xxiii, p. 412, 1891).

RIPPEL (K.). **Saugkraftmessungen an Sporen von Cladosporium fulvum Cooke und anderen Pilzen und Grundsätzliches zur Methodik der Saugkraftmessungen.** [Osmotic measurements on the spores of *Cladosporium fulvum* Cooke and other fungi, with observations on the principles underlying the method of osmotic measurements.]—*Arch. für Mikrobiol.*, iv, 2, pp. 220–228, 1 graph, 1933.

The author traces a direct correlation between the osmotic capacity of the spores of certain fungi and their speed of germination. In a 1·3 mol. cane sugar solution (65·8 atmospheres), the spores of *Cladosporium fulvum* required 72 hours for 100 per cent. germination, the corresponding periods for *C. herbarum*, *Botrytis cinerea*, and a species of *Botrytis* found parasitizing *C. fulvum* [*R.A.M.*, xii, p. 194] being 48, 24, and 10 hours, respectively. *C. fulvum*, therefore, possesses the lowest osmotic capacity of the four organisms under observation. This fact was confirmed by a further germination test in a 1·96 mol. cane sugar solution (112 atm.), in which only a trace of growth by *C. fulvum* was detected after 10 days; after 5 days 70 per cent. of the *C. herbarum* spores had germinated, and after 3 days 100 per cent. of *B. cinerea* and *B.* sp. (90 per cent. of the last-named on the first day). The immensely high osmotic capacity of the *Botrytis* found on *C. fulvum* in comparison with the latter provides the nutrient-physiological basis for the parasitism of the one by the other. The apparent susceptibility of *C. fulvum* to sodium chloride in previous tests would appear from the present results to be due to its poor osmotic capacity rather than to the action of the relatively weak fungicide in question.

CHALLENGER (F.). **The formation of volatile arsenic compounds by moulds.**—*Indus. Chem.*, ix, 99, p. 134, 1933.

According to Gosio arsenical gas is produced from media con-

taining arsenic [*R.A.M.*, xii, p. 384] by *Aspergillus glaucus*, *A. virens*, *Mucor mucedo*, *M. ramosus*, and *Penicillium brevicaule*.

The writer inoculated breadcrumbs with strains of *P. brevicaule* and added to the cultures aqueous solutions of various sterilized arsenic compounds. Using arsenious oxide precipitates were obtained on absorption in acid mercuric chloride solution of the di- and monomercurichlorides of trimethylarsine, $(CH_3)_3As.2HgCl_2$ and $(CH_3)_3As.HgCl_2$. Arsenical or Gosio gas, then, is trimethylarsine, a volatile liquid of boiling-point 53° C., the identity of the substance being further confirmed by the formation of trimethylarsine-hydroxynitrate and -hydroxypicrate and trimethylbenzylarsonium picrate. When arsenious oxide is replaced by sodium methylarsonate or sodium cacodylate, a strong garlic odour is evolved. When sodium ethylarsonate was added to cultures of the mould on sterile breadcrumbs the resultant gas was identical with synthetic dimethylethylarsine. These results clearly show that the moulds are capable of methylating arsenic in certain types of organic or inorganic combination, and also of effecting reduction of quinquevalent to tervalent arsenic.

A similar methylation is observed when *P. brevicaule* is grown on breadcrumbs containing sodium selenate, the gas evolved being identical with dimethyl selenide, $(CH_3)_2Se$. With potassium telluride a malodorous gas is eliminated, probably dimethyl telluride, $(CH_3)_2Te$.

AHMET (H.). **Untersuchungen über Tracheomykosen.** [Investigations on tracheomycoses.]—*Phytopath. Zeitschr.*, vi, 1, pp. 49–101, 9 figs., 1 graph, 1933.

The salient points in the phase of these studies dealing with toxin formation by *Fusarium vasinfectum* and *F. lycopersici*, the agents of cotton and tomato wilt, respectively, have already been noticed from another source [*R.A.M.*, xii, p. 387]. This forms the major part of the investigations reported.

Both fungi were found to be capable of attacking their respective hosts without the aid of other organisms or of mechanical wounding. Two types of infection may be differentiated among young plants, namely, chronic (especially in tomato) and acute, varying (under experimental conditions) according to the method of inoculation. Soil infections caused the acute type in cotton seedlings, whereas wound infections by inoculation on the plant itself were difficult to secure. Older plants generally develop the disease in an acute form. Marked differences in the length of the incubation period were induced by alterations in the mineral food supply, the wilt symptoms developing soonest (17 days) in the plants deprived of potash and latest (58 days) in those receiving little nitrogen.

Transpiration was found to be reduced in both chronically and acutely diseased tomato plants.

On the one hand, the fusarioses of tomato and cotton are associated with mechanical obstruction of the vessels by the hyphae, a condition remediable by the removal of the infected portions, while on the other, an important part is played by the toxins produced by the fungi within the plants.

RIVERA (V.). **Condizioni fisiologiche di predisposizione di tessuti vegetali ad attachi crittogamici.** [The physiological conditions predisposing plant tissues to fungal attacks.]—*Nuovo Giorn. Bot. Ital.*, N.S., xxxix, 4, pp. 689–690, 1932.

After pointing out that it is known that in attacks by the Erysiphaceae the host tissues show resistance as long as the green cells are in a state of maximum turgidity and that, conversely, reduction in resistance always follows a decrease in such turgescence [*R.A.M.*, iv, p. 108], the author states that the same observation also applies to epidemic attacks by other groups of fungi; hence, the fact that infection becomes possible only when there is reduced turgescence with a consequent suspension or weakening of anabolic activity is of the first importance in the study of the conditions in which plants become susceptible to fungal attack in general.

JØRGENSEN (C. A.) & NIELSEN (O.). **Kartoffelsorter og Kartoffelsygdomme. Orienterende undersøgelser.** [Potato varieties and Potato diseases. Preliminary investigations.]—*Tidsskr. for Planteavl*, xxxix, 2, pp. 295–315, 1933.

A detailed and tabulated account is given of the writers' investigations, carried on at Lyngby, Denmark, from 1926 to 1930, on the reaction of some standard potato varieties to late blight (*Phytophthora infestans*), leaf roll, mosaic, *Rhizoctonia* [*Corticium*] *solani*, blackleg (*Erwinia phytophthora*) [*Bacillus phytophthorus*], and scab (*Actinomyces* spp.).

In discussing the reaction of the different varieties to *P. infestans*, the tops and tubers are separately considered. Highly resistant tops are a feature of Betula and Silesia, the former showing the same character as regards the tubers, while the latter is only moderately resistant to tuber infection. Highly susceptible in respect of top infection are Sigyn and Æggeblomme [Egg Plum], the former being moderately susceptible also to tuber attack and the latter extremely so. A marked degree of resistance to tuber infection characterizes Parnassia, Majestic, Rubin, Pepo, Burbank, King George, Rheinland, Magnum Bonum, Acme, and Deodara [cf. *R.A.M.*, xi, p. 71], while a number of other varieties are intermediate in their reaction both to top and tuber invasion.

Some varieties with very susceptible tops have resistant tubers and vice versa. The increased yield obtained by spraying with Bordeaux mixture ranged from 3 to 27 per cent., the former for Pepo (susceptible tops but very resistant tubers) and the latter for Richter's Imperator (susceptible tops but fairly resistant tubers).

Both mosaic and leaf roll are stated to be prevalent at the Lyngby Phytopathological Experiment Station and in the vicinity [ibid., viii, p. 152; ix, p. 741; xi, p. 467], and for four years comparative observations have been conducted on local material and on plants of the same varieties grown at Tylstrup, Vendsyssel [extreme north of Jutland], where both diseases occur only to a very limited extent. In the fourth year the northern-grown tubers were brought down for testing at Lyngby. The Pepo and King George varieties proved highly resistant to both disturbances when grown throughout at Lyngby; Acme, Rheinland, Rubin,

Bravo, and Sigyn gave satisfactory results as regards leaf roll but were very susceptible to mosaic. Magnum Bonum and Egg Plum contracted leaf roll in an exceptionally severe form. Of the northern material, Askebladet, Juli, and Early Rose proved highly susceptible to leaf roll (Juli also to mosaic), and the yields of these varieties were much reduced by cultivation in the unfavourable environment of Lyngby. Sharpe's Victor and Webb's Early gave more promise of resistance.

Tuber infection by *C. solani* ranged from 8 to 46·8 per cent., being most severe on Kerr's Pink, Rubin, Up-to-Date, Acme, Silesia, and Majestic, while Rheinland, Deodara, and Magnum Bonum remained relatively clean.

Blackleg did not assume a very serious form during the period of the tests. The most susceptible varieties appear to be Betula, Deodara, and Kerr's Pink. Scab was also relatively unimportant, the early varieties being little affected (except Goldperle), while among the later ones Up-to-Date, King Edward, Magnum Bonum, and Kerr's Pink are liable to heavy attacks.

GARBOWSKI (L.). **Choroby virusove Ziemniaków w okresie 1928–1932 r.** [Virus diseases of Potatoes during the period from 1928 to 1932.]—*Prace Wydz. Chorób Roślin Państw. Inst. Naukow. Gospod. Wiejsk. w Bydgoszczy* [*Trans. Phytopath. Sect. State Inst. Agric. Sci. in Bydgoszcz*], 13, pp. 3–136, 24 pl., 1933. [French summary.]

In the first part of this paper the author gives a very comprehensive review of the latest developments in the study of the so-called 'degeneration' diseases of the potato, both along the lines followed by the German school in Berlin-Dahlem, which tends to explain them by the influence of physiological and ecological factors on the development of the plant, and along those of the English, American, and Dutch workers who claim that they are due to the existence of different virus entities, and to whose views he personally adheres. Most of the work reviewed has been noticed from time to time in this *Review*.

In the second part notes are given on the behaviour in the field in Poland during the period from 1928 to 1932, in regard to virus diseases, of 46 Polish, 49 German, 11 English, and 4 Dutch varieties of potato, the great majority of which exhibited symptoms of mixed infection. Typical leaf roll was seen in the varieties Alma, Anna, and Wohltmann, while acute crinkle, with some admixture of mosaic, was shown by Topaz, Ursus, and Minister Miquel. Under the conditions prevalent at Bydgoszcz the greatest resistance to infection with the virus diseases was exhibited by the varieties Svitez, Tytan, Hermes, Wloszanowskie 12 and 112, Wekaragis, and Parnassia. The effect of the virus diseases on the yield and size of tubers is shown in each case in comparative tables. Aucuba mosaic was found on the variety Juli, and streak on a number of varieties, this being the first record of both diseases for Poland.

Tables are given showing the diminution in yield caused by various virus diseases in a number of varieties including Early Rose and Arran Chief, and there are brief notes on the reaction

to virus infection of several other British varieties under local conditions.

A bibliography of 92 titles is appended.

LOUGHNANE (J. B.). **Insect transmission of virus A of Potatoes.** —*Nature*, cxxxi, 3319, pp. 838–839, 1933.

Attempts at the Albert Agricultural College, Glasnevin, Dublin, to transmit potato crinkle [*R.A.M.*, xii, p. 588] from the President and Irish Chieftain varieties by means of the aphid *Myzus persicae* resulted, in healthy specimens of President, merely in a mild form of veinal mosaic. The latter was not simple mosaic, for it produced acronecrosis by grafting on British Queen and Up-to-Date, and veinbanding by needling to tobacco, while it caused no symptoms on *Datura stramonium*. These manifestations are typical of Murphy's virus A [ibid., xi, p. 740]. When simple mosaic was grafted on President containing this aphid-transmitted disease, typical and persistent crinkle symptoms developed in the stock plants.

Virus A was also transmitted direct from Irish Chieftain potatoes [on which it produces very faint or no symptoms: loc. cit.] by means of *M. persicae* to healthy President, British Queen, Up-to-Date, President containing a simple mosaic derived by needle inoculation from crinkle, and tobacco, with the same results as described above.

It is evident, therefore, that *M. persicae* is an efficient vector of virus A from potato to potato and tobacco, and that it transmits it selectively to the exclusion of the simple mosaic element from crinkled plants. The aphid-borne virus *y* is not identical with A, being readily returned by needle from tobacco to potato, in which it produced crinkle and leaf-drop streak in the President variety. Virus A is not thus returnable, nor has it been known to produce such symptoms in this variety. As already suggested by Murphy [ibid., xi, p. 738], virus A may also have been present in Smith's crinkle from Myatt's Ashleaf, in which case it would be carried by the insect along with *y*, and since both produce similar veinbanding symptoms in tobacco, no evidence of its presence in that plant would be apparent, while the effect of this particular *y* on President was so severe as to obscure the faint traces of A.

Virus A may also be transmissible by *M. circumflexus*, but attempts to cause infection by means of *M. solani*, *Lygus pabulinus*, and *Calocoris bipunctatus* gave negative results.

SMITH (O.). **Effect of soil reaction on the growth of the Potato.** —*Amer. Potato Journ.*, x, 6, pp. 118–121, 1933.

It is commonly supposed by potato-growers that the incidence of scab [*Actinomyces scabies*: *R.A.M.*, xii, p. 651] increases in proportion to the alkalinity of the soil, and up to a certain point most experiments confirm this belief. However, a series of field trials in western New York indicated that, with an increase in the $P_H$ of the soil beyond 6·51, the amount of infection decreases. Thus, tubers grown in soil with a reaction of $P_H$ 7·16 to 7·45 were less scabby than those in any other plot above $P_H$ 5, the maximum

amount of infection occurring in plots with a hydrogen-ion concentration ranging from $P_H$ 6·08 to 6·51. In tests with the Green Mountain variety on Long Island, P. H. Wessels (*Cornell Agric. Exper. Stat. Bull.* 536, 1932) found that the amount of scab continued to increase up to $P_H$ 6·9 or 7.

SZYMAŃSKI (W.). **Studja biochemiczne nad porażeniem Zemniaków grzybkiem raka ziemniaczanego.** [Biochemical studies on Potato wart disease.]—*Prace Wydz. Chorób Roślin Państw. Inst. Naukow. Gospod. Wiejsk. w Bydgoszczy* [*Trans. Phytopath. Sect. State Inst. Agric. Sci. in Bydgoszcz*], 13, pp. 141–162, 1933. [French summary.]

This is a summarized report of the author's investigation of the biochemistry of healthy potato tubers (Deodara variety), as compared with that of tubers infected with wart disease (*Synchytrium endobioticum*) and that of the wart outgrowths themselves. The results [which are presented in the form of tables] showed that the specific gravity of wart-infected tubers was greater than that of healthy ones (averages 1·119 and 1·108, respectively), and that of the warted tissue itself smaller (1·074). The dry weight of the infected tuber tissue averaged 28·47 per cent. of the fresh material in 1929 and 25·9 per cent. in 1932, of healthy tissue 24·95 and 22·7 per cent., respectively, and of the warted tissue 22·3 and 19·8 per cent., respectively, while the average ash contents amounted to 4·45, 4·82, and 7·88 per cent., respectively. Quantitative analysis of the ash obtained from healthy and warted tissue showed a greater accumulation in the latter of most of the mineral constituents, especially of iron (0·024 and 0·123 per cent. $Fe_2O_3$, respectively), manganese (0·00180 and 0·00388 per cent. MnO, respectively), copper (0·00216 and 0·00460 per cent. CuO, respectively), and nitrogen (0·0884 and 0·1056 per cent. aminoacid and polypeptide nitrogen). It is suggested that it is these elements that stimulate the proliferation of the warted tissue in infected tubers.

MEYER-HERMANN (K.). **Der Einfluss von Konservierungsmitteln auf die Haltbarkeit der Kartoffeln.** [The effect of preservatives on the keeping quality of Potatoes.]—*Deutsche Landw. Presse*, lx, 22, p. 282, 1933.

Excellent control of the tuber rotting due to *Phytophthora infestans* among potatoes stored in a cellar is reported from the Harleshausen (Germany) Plant Protection Station as a result of sprinkling 'karsan' (Chem. Fabrik L. Meyer, Mainz) on the floor and between the layers of tubers. Even when rotting had already developed actively its spread to the sound tubers was immediately arrested by treatment with the dust so that by the spring only individual cases of rotting were found, while the tubers left untreated as controls were completely rotted away. There is also some indication (requiring further confirmation) that precocity of germination in store and consequent premature depletion of the tubers may be avoided by the use of karsan.

SCHLUMBERGER [O.]. **Fusskrankheiten der Kartoffel.** [Foot rots of the Potato.]—*Mitt. Deutsch. Landw.-Gesellsch.*, xlviii, 22, pp. 487–488, 1933.

Popular notes are given on the conditions predisposing potatoes to infection by *Rhizoctonia* [*Corticium solani*] and blackleg [*Bacillus phytophthorus*] in Germany, with instructions for their avoidance by appropriate cultural measures.

CHAMBERLAIN (E. E.) & BRIEN (R. M.). **Verticillium-wilt of Potatoes and Tomatoes in New Zealand.**—*New Zealand Journ. of Sci. & Techn.*, xiv, 6, pp. 366–377, 4 figs., 1933.

This is a more technical account of the wilt disease of Ancklander Tall-top and Auckland er Short-top potatoes and glasshouse tomatoes caused by *Verticillium albo-atrum* in New Zealand than that already noticed [*R.A.M.*, xii, p. 403]. Cross-inoculations with isolations of the fungus gave positive results on both hosts. The symptoms of the disease and the morphology of the parasite are described, and the taxonomy of the latter is discussed. Specimens of tomatoes received from Nelson, South Island, after the preparation of this paper for publication, appear to be infected by a distinct strain of *V. albo-atrum*.

NISIKADO (Y.) & MATSUMOTO (H.). **Studies on the physiological specialization of Gibberella fujikuroi, the causal fungus of the Rice 'bakanae' disease.**—*Trans. Tottori Soc. Agric. Sci.*, iv, 3, pp. 200–211, 1933. [Japanese, with English summary.]

Inoculation experiments were carried out with 66 strains, collected from various parts of Japan, of *Gibberella fujikuroi*, the agent of the 'bakanae' disease of rice, and with five strains of *G. moniliformis* and its var. *majus*, maize being used as a host in preference to rice owing to the particular clearness of the symptoms on the former [*R.A.M.*, xii, p. 590]. Marked differences in pathogenicity, as indicated by the degree of overgrowth on the inoculated plants, were shown by the various strains.

THOMAS (K. M.). **The 'foot-rot' of Paddy and its control.**—*Madras Agric. Journ.*, xxi, 6, pp. 263–272, 1 pl., 1933.

The rice disease (for which the descriptive name foot rot is suggested), first described by the author from the Godavari Delta in 1931 [*R.A.M.*, x, p. 336], has since been found to occur in other parts of the Madras Presidency, and to affect either sporadically or as a result of inoculation over fifty varieties from all the important rice tracts of the province. In addition to the symptoms previously described, an abnormally profuse branching of the main roots, giving the root system a woolly appearance, was seen on well-established plants affected with the trouble, a feature which, together with the production of adventitious roots from the upper nodes of infected fully grown plants, and the complete failure of transplanted infected seedlings to recover, seems to distinguish this disease from the Japanese 'bakanae' disease [see preceding abstract], with which it has many features in common. The causal organism was isolated and found to be an as yet unidentified

species of *Fusarium*, the perfect stage of which has not been obtained so far in nature or in pure culture.

Field experiments from the end of 1930 to 1932 indicated that good control of the disease is obtainable by seed-grain treatments, among which formalin (1 per cent. for 15 minutes), hot water (55° C. for 30 minutes), copper sulphate (2 per cent. solution for 30 minutes), ceresan dust (1 gm. per 1 lb. seed), uspulun (0·5 per cent. solution for 30 minutes), and granosan dust (1 gm. per 1 lb.) [ibid., xii, p. 140] were the most effective. Field tests in 1931 of 41 distinct varieties of rice, in which the seed was steeped in a spore suspension of the fungus, showed that none of the varieties was absolutely immune, but that relative resistance ranged from almost complete resistance (in Wateribune, Aryan, and G.E.B. 24) to great susceptibility.

MURRAY (R. K. S.). **Mycologist's report for 1932.**—*Eleventh Ann. Rept. Rubber Res. Scheme (Ceylon), 1932*, pp. 18–21, 1933.

This is a brief report of the work done during 1932 in the investigation of diseases of *Hevea* rubber in Ceylon, most of the information contained having already been noticed from other sources [cf. *R.A.M.*, xii, p. 591]. A brief note is included on bark renewal experiments, a report on which is in course of publication.

DE JONG (W. H.). **Het parasitisme van Rigidoporus microporus (Swartz) Van Overeem, Syn: Fomes lignosus Klotzsch, bij Hevea brasiliensis.** [The parasitism of *Rigidoporus microporus* (Swartz) Van Overeem, Syn: *Fomes lignosus* Klotzsch, on *Hevea brasiliensis*.]—*Arch. voor Rubbercult. Nederl.-Indië*, xvii, 4–6, pp. 83–104, 1933. [English summary.]

An inspection of several thousand *Hevea* rubber trees near Kisaran (east coast of Sumatra) showed that *Fomes lignosus* [*R.A.M.*, xii, p. 54] was present on the decayed roots of trees of all ages up to 22 years. The rot caused may be either dry or moist, the latter apparently due to secondary bacterial infection. A large number of the trees inoculated with pure mycelial cultures of *F. lignosus* developed a profuse growth of mycelium on the root-collars and roots, but in no case did decay ensue and the rhizomorphs finally disintegrated. Infection did not seem to be promoted by the presence of wounds on the inoculated roots. Out of twelve nine-month-old trees of poor growth but otherwise healthy, inoculated with pure cultures of the fungus on fair-sized pieces of sterilized wood, one eventually died as a result of the disease. Abundant mycelial development usually followed inoculation with the fructifications of *F. lignosus*, but in no case did rotting result, even on wounded roots. When the inoculum consisted of roots externally covered by mycelium but not decayed, there was an occasional development of superficial infection but no rotting. When decayed wood from the plantations was placed on unwounded, healthy roots, several trees contracted infection and died. It was observed, in connexion with these experiments, that the decay caused by *F. lignosus* often stops of its own accord, the infected areas becoming surrounded by callus and finally healing completely. This process usually coincides with the disintegration

of the inoculating material. In other cases, however, the rotting continues to develop after the exhaustion of the inoculum, probably because the trees have been seriously weakened by the decay caused by the original attack. A detailed account is given in tabular form of two series of inoculation tests, one comprising eleven 14-year-old trees on red soil, and the other ten 18-year-old trees on white and sandy-white soil. In the latter area three trees were killed by the disease within two years from inoculation.

The outcome of these experiments appears to indicate that *F. lignosus* is only a weak parasite on rubber except under special environmental conditions which stimulate the growth of the fungus and impair that of the trees. Among the factors affecting the decay of rubber roots by *F. lignosus* are the presence of decaying wood in close contact with the roots; the size, quantity, and nature of the inoculum; the dimensions of the tree; natural variations in resistance probably due to predisposing environmental conditions; nature of the soil, red soils and quartz sand being particularly favourable to the development of the fungus; the situation with regard to ground cover [loc. cit.]; the previous vegetation of the area, epidemics having been reported on red soils formerly planted with *Ficus elastica*, on red soils and quartz sand previously carrying coco-nuts, and on sites where rubber was preceded by *Koompassia malaccensis* and *Artocarpus elastica*; and manuring treatment, an increase of infection following the combined application of nitrogen, phosphate, potash, and manganese sulphate.

An estimate of the root disease situation in a given area should not be based solely on the presence of mycelial contaminations, which are not necessarily followed by decay. Even where such decay is present, it may cease to extend without treatment, so that a single inspection is of little value but requires to be supplemented by repeated examinations to ascertain the progress of the rot, or still better by an accurate record of the mortality due to the disease.

MA (ROBERTA M.). **Seasonal variations of fungi in soils in the vicinity of Peiping.**—*Peking Nat. Hist. Bull.*, vii, 4, pp. 293–297, 1 graph, 1933.

The results [which are tabulated and discussed] of the writer's study of the seasonal variations among the soil micro-organisms of Peking [*R.A.M.*, xii, p. 656] showed that July is the most favourable month for the growth of the soil fungi and December the least so [cf. ibid., xii, p. 534]. There is a gradual increase in the number of fungi from January to May and a sudden augmentation from June to July, followed by a rapid decrease from July to August and a further slow diminution from September to December. In fertile soils the number of fungi and variety of species are greater than in infertile, a fact that is evidently correlated with the presence in the former of organic matter.

ZATTLER (F.) & WEIGAND (K.). **Über Konzentration der Kupferkalkbrühe, Zeitpunkt und Häufigkeit der Bespritzungen bei der Bekämpfung der Peronosporakrankheit des Hopfens.**—[On the concentration of the Bordeaux mixture and the time

and frequency of treatments in the control of the *Peronospora* disease of Hops.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz*, xi, 3–4, pp. 57–68, 1 graph, 1933.

The best results in a series of experiments [the details of which are fully described and tabulated] on the control of hop downy mildew (*Peronospora*) [*Pseudoperonospora humuli*] in a 15-year-old Hallertau plantation in Bavaria were obtained in 1932 by six applications between 8th July and 6th August of 1 per cent. Bordeaux mixture, followed by a final treatment (18th August) at half strength [*R.A.M.*, xii, p. 243]. The yield of the plots receiving this schedule averaged 368·30 kg. dry hops per 1,000 plants, compared with 112·50 for those left unsprayed. The next best treatment consisted in four applications at 1, two at 2, and 1 at 0·5 per cent., resulting in a yield of 342·50 kg. per 1,000 plants. From the economic standpoint the former schedule is adjudged to be entirely satisfactory.

MARTIN (J. P.). **Pathology.**—*Ann. Rept. Ctte. in charge of the Exper. Stat. for the year ending September 30th, 1932* (ex *Proc. Hawaiian Sugar Planters' Assoc., Fifty-second Ann. Meeting, 1932*), pp. 23–42, 1933.

The following are some of the many items of interest in this report. Further investigations into brown stripe of sugar-cane [*Helminthosporium stenospilum*: *R.A.M.*, xi, p. 540] showed that in severely affected localities the soil was deficient in available phosphates, and the cane juice low in $P_2O_5$; every striped cane contained less $P_2O_5$ than did healthy canes of the same variety. In certain areas badly affected two years ago heavier applications of phosphoric acid have been followed by a marked decrease in infection, with increased yields per acre both of cane and sugar.

Partly owing to the prevailing weather but mainly as a result of abandoning the practice of applying nitrogenous fertilizers late in the autumn the losses sustained from eye spot [*H. ocellum*: ibid., xi, p. 4] were very much less than those experienced annually from 1924 to 1929.

The marked reduction of mosaic [ibid., xi, p. 539] in areas where it was formerly rife is due to systematic roguing, the use of selected cuttings taken from resistant varieties, and the control of weeds. In experiments by C. W. Carpenter mosaic was mechanically transmitted by Sein's leaf-slip method [ibid., ix, p. 678] to several varieties, an electrically operated needle being used to make the inoculations, in which speed of transfer is important, the mosaic virus deteriorating very rapidly on exposure [cf. ibid., xii, p. 660].

Symptoms identical with those of chlorotic streak of sugar-cane [ibid., xi, p. 674] were found on *Coix lacryma-jobi*. A modified form of hot-water treatment, which consisted in placing the cane cuttings in a volume of water at 53° C. such that after 20 minutes the temperature was reduced to about 50°, gave control of the disease and was less injurious to germination than maintaining a constant temperature. Attempts to transmit chlorotic streak from cane to cane and from *C. lacryma-jobi* to canes by the leaf-

slip method, as well as from diseased canes to healthy cane cuttings with cane knives were unsuccessful. While the author was attending the fourth Congress of Sugar Cane Technologists in Porto Rico in 1932 the disease was recorded there for the first time, and it was then agreed by the pathologists present that the diseases known in Hawaii as chlorotic streak, in Java as the 'fourth disease' [ibid., xii, p. 593], and in Australia as 'pseudo leaf scald' are identical.

So-called 'growth failure' [ibid., vii, p. 271] was in many areas rectified by adjusting soil deficiencies. Non-parasitic root-rot, though previously severe, caused scarcely any losses among seedlings in 1931–2, and it now appears that the disease can be completely controlled by sanitation and constant vigilance in the propagating house. The parasitic form, due to *Pythium* [*aphanidermatum* or a related species: ibid., xi, p. 540], is receiving less attention than formerly, as it is now regarded as a minor factor in the commercial cultivation of the standard varieties.

A preliminary study was made of a soft rot of the nodes of sugar-cane stalks ('nodal stalk rot'), most marked on the underground parts, in which the rotted tissue is watery and soft at first and later turns dark brown. The lower leaf sheaths may be occasionally penetrated and the node beneath affected, the leaf blades turning yellow or dying prematurely. The diseased area extended only a slight distance inside the stalk, but frequently the stalks were completely girdled at the node and the root primordia killed.

An internal stalk necrosis was also observed as a browning of the tissue usually at or slightly below the level of the node. Small, watery areas appeared, which later turned brown or, occasionally, black. The parenchymatous tissue in the internode disintegrated, leaving small cavities surrounded by brownish tissues. The affected areas varied from minute spots to circles 0·5 in. in diameter, while occasionally the entire stalk was affected. The trouble appeared to be of physiological origin.

On p. 63 of this report it is stated that susceptibility to eye spot [*H. ocellum*] is recessive. Highly susceptible canes selfed or crossed together produce only susceptible seedlings, while resistant canes selfed or crossed together give a majority of resistant and a minority of susceptible seedlings.

CIFERRI (R.). **La distribuzione e la nomenclatura dei carboni della Canna da Zucchero e delle specie affini.** [The distribution and nomenclature of the smuts of Sugar-Cane and allied species.]—Reprinted from *Boll. Studi ed Informaz. R. Giard. Colon. di Palermo*, xiii, 7 pp., 1933. [English summary.]

After briefly discussing the smuts (*Ustilago* spp.) reported on *Erianthus* and *Saccharum* spp. the author gives an analytical key summarizing their differential characters, synonymy, hosts, and distribution. He considers that the presence of smut (*U. scitaminea*) on cultivated sugar-cane in North America, Trinidad, and British Guiana is doubtful, but states that its report from Brazil has recently been confirmed by Freise [*R.A.M.*, ix, p. 808].

A bibliography of 25 titles is appended.

Abbott (E. V.). **Physiologic forms of Colletotrichum falcatum Went.**—*Phytopath.*, xxiii, 6, pp. 557–559, 1933.

The results [which are tabulated] of a comparative study of four isolations of *Colletotrichum falcatum* from three sugar-cane varieties, viz., L–7 and F–1 from P.O.J. 213 in Louisiana and Florida, respectively, G–2 from Cayana in Georgia, and L-31 from Co. 281 in Louisiana [*R.A.M.*, xi, p. 543], indicate the existence within the species of three physiologic forms. L–7 and F–1 have approximately the same indices of virulence, a measure of which was obtained by calculating the ratio of spread of infection to the total length and width of the inoculated internode and multiplying the longitudinal by the lateral ratios, 1·00 being complete penetration of the length or breadth of the internode and a higher figure representing spread to other internodes above or below. These two isolations are considered to belong to the same physiologic form. L-31 is more virulent on all three varieties than any of the other forms, the susceptibility of the ordinarily resistant Co. 281 being particularly noticeable. G–2 is weakly parasitic in comparison with the others and is classed as a third form. Two kinds of resistance to red rot are possessed by different varieties, namely, (1) functional, by those germinating quickly and forming strong roots, through the primordia of which the fungus is unable to enter; and (2) physiological, by those in which the development of the organism within the stalk tissues is retarded after infection has taken place.

Mout (M. G.) & Sluis (T. A. S.). **Enkele aan plantproven op het gebied van voorbemonstering en te behalen product.** [Some planting tests in connexion with preliminary sampling and the product eventually obtained.]—*Arch. voor Suikerind.*, Deel I, xli, 11, pp. 381–418, 4 diags., 7 graphs, 1933.

A comprehensive and fully tabulated account is given of the writers' investigations in Java of the influence of *Fusarium* attack in causing an imperfect correspondence between the data afforded by periodical samplings of P.O.J. 2878 cane and the actual yields obtained. The severity of the attack is progressive during the ripening period and may result in a heavy reduction in the crop, especially on light soils and in April plantings. The writers recommend the institution of so-called 'history tests' on areas specially set apart for the purpose of observing and studying the progress of infection.

Teng (S. C.). **Some fungi from Canton.**—*Contrib. Biol. Lab. Sci. Soc. of China*, Bot. Ser., viii, 2, pp. 121–128, 1932.

An annotated list is given of 41 fungi collected, mostly by the writer, in Canton, China, including *Phytophthora colocasiae* [*R.A.M.*, xi, p. 769] on *Colocasia esculenta*, *Ustilago esculenta* on *Zizania latifolia* [*Z. aquatica*], *U. sacchari* [*U. scitaminea*] on sugar-cane [see preceding page], *Sphaerophragmium acaciae* on *Albizzia lebbek*, *Exobasidium sawadae* on *Cinnamomum cassia*, *Colletotrichum nigrum* and *Gloeosporium piperatum* [both considered to be imperfect forms of *Glomerella cingulata*: ibid., xi,

p. 803] on *Capsicum annuum*, and *Cercospora cruenta* [ibid., xi, pp. 87, 130] on bean (*Phaseolus vulgaris*).

TENG (S. C.). **Fungi of Chekiang. II.**—*Contrib. Biol. Lab. Sci. Soc. of China*, Bot. Ser., viii, 2, pp. 103–118, 1 pl., 1932.

A further annotated list is given of 87 fungi (including four new species) collected by the writer in the Chekiang district of China [*R.A.M.*, xii, p. 396].

TENG (S. C.) & LING (L.). **Fungi of Chekiang. III.**—*Contrib. Biol. Lab. Sci. Soc. of China*, Bot. Ser., viii, 3, pp. 271–279, 1 fig., 1933.

A further annotated list is given of 34 species of fungi (including two new ones) collected, mostly by the writers, in the Chekiang district of China [see preceding abstract].

TENG (S. C.). **Fungi of Nanking. III.**—*Contrib. Biol. Lab. Sci. Soc. of China*, Bot. Ser., viii, 2, pp. 143–152, 1933.

A further annotated list is given of 41 species of fungi collected, mostly by the writer and C. I. Shen, in the Nanking district of China [*R.A.M.*, xii, p. 395]. Oaks (*Quercus dentata* and *Q. serrata*) were infected by *Erysiphe polygoni* and *Microsphaera alni* [ibid., xi, p. 213], the latter occurring also on chestnut (*Castanea mollissima*). *Glomerella cingulata* is believed to be the primary agent of an anthracnose of *Gingko biloba* leaves, *Pestalozzia sinensis* [ibid., xi, p. 746 and next abstract], which is constantly associated with the lesions, being probably only a saprophyte. *Sclerotium tulipae* [ibid., xi, p. 388] was observed on *Liriope graminifolia* [*L. spicata*].

SHEN (C. I.). **Fungi of Nanking. IV.**—*Contrib. Biol. Lab. Sci. Soc. of China*, Bot. Ser., viii, 2, pp. 153–161, 1932.

In this continuation (comprising 42 species) of the annotated list of Nanking fungi [see preceding abstract] Latin diagnoses are given of *Pestalozzia sinensis* on *Gingko biloba* [loc. cit.], and of *Phyllosticta caryotae* n. sp. on living leaves of *Caryota ochlandra*. *Colletotrichum ampelinum* var. *parthenocissi* var. nov. was found on living leaves of *Parthenocissus tricuspidata*.

TENG (S. C.). **Fungi of Nanking. V.**—*Contrib. Biol. Lab. Sci. Soc. of China*, Bot. Ser., viii, 3, pp. 253–270, 1 fig., 1933.

A further annotated list is given of 71 species of fungi (including three new ones) collected, mostly by the writer, in the Nanking district of China [see preceding abstracts].

DA CAMARA (E. de S.). **Contributiones ad mycofloram Lusitaniae. Centuria X.** [Contributions to the mycoflora of Portugal. Century X.]—*Rev. Agron.*, xx, 1, pp. 5–63, 54 figs., 1932. [Received August, 1933.]

This is an annotated list of 100 fungi of Portugal [cf. *R.A.M.*, ix, p. 489], 16 of which are stated to be new to science and furnished with Latin diagnoses, while 43 had not previously been

recorded from the country. In these two groups the following may be mentioned. *Physalospora elasticae* was observed in association with *Phyllosticta roberti* on *Ficus elastica* leaves in the Lisbon Colonial Garden. *Leptosphaeria buxina* n. sp. and *L. scolecosporarum* n. sp. occurred on *Buxus sempervirens* and *Quercus suber*, respectively. *Chaetophoma eriobotryae* n. sp. was observed on loquat branches, which also bore *Verticillium cinnamomum* n. sp. Privet (*Ligustrum vulgare*) leaves bore large, yellowish-white, black-bordered spots at the tips and margins due to *Macrophyllosticta ligustri* n. sp. *Ascochyta buxina* and *A. citricola* (the latter in conjunction with *Gloeosporium citri*) were found on *B. sempervirens* and orange leaves, respectively. *Diplodia cinnamomi* n. sp. was observed on cinnamon (*Cinnamomum dulce*) twigs, and *Diplodina antirrhinicola* n. sp. on those of *Antirrhinum* sp. *Coniothyrium shiraianum* was found on bamboo (*Bambusa* sp.) stems.

A subdivision of the genus *Leptosphaeria* Ces. & de Not. is proposed as follows: *Leptosphaeria*, *Leptosphaerella* Sacc., *Dendroleptosphaeria* n. g., and *Lopholeptosphaeria* n. g., and a list is given of the species referred to each of these genera.

CIFERRI (R.). **Ustilaginales esotici nuovi o rari. I.** [New or rare exotic Ustilaginales. I.]—*Nuovo Giorn. Bot. Ital.*, N.S., xl, 2, pp. 252–268, 1 fig., 1933. [English summary.]

This is an annotated list of some twenty species of Ustilaginales, mostly from the tropics. It contains seven species which are described as new to science, Latin diagnoses being appended in each case, and also a new genus, *Liroa*, which is established for *Farysia emodensis* (syn. *Ustilago treubii*) on *Polygonum chinense* from Java; the fungus is renamed *L. emodensis*, and a table is given showing the chief differences between the genera *Farysia* and *Liroa*.

HIRATSUKA (N.) & HASHIOKA (Y.). **Uredinales collected in Formosa. I.**—*Trans. Tottori Soc. Agric. Sci.*, iv, 3, pp. 156–165, 1933.

An annotated list is given of 60 Uredinales collected by Hashioka in Formosa during 1932. *Uromyces decoratus* on *Crotalaria juncea* and *C. vitatoni* is amongst the species stated to be new to Japan.

HIRATSUKA (N.). **On species of the Melampsoraceae collected in Nikko and its vicinity.**—*Trans. Tottori Soc. Agric. Sci.*, iv, 3, pp. 143–155, 1933.

Taxonomic notes [mainly in Japanese, with some Latin annotations] are given on 27 species of Melampsoraceae collected in and around Nikko [*R.A.M.*, xii, p. 596], among which may be mentioned: *Pucciniastrum castaneae* on chestnut (*Castanea vulgaris* [*C. sativa*] var. *japonica*); *P. coryli* on *Corylus rostrata* var. *sieboldiana*; *Thecopsora myrtillina* and *T. vacciniorum* [ibid., ix, p. 420] on *Vaccinium uliginosum* and *V. vitis-iduea*, respectively; and *Chrysomyxa expansa* [ibid., ix, p. 205] on *Rhododendron degronianum*.

Hopkins (J. C. F.). **Rhizoctonia lamellifera Small: a distinct species of the Rhizoctonia bataticola group of fungi.**—*Proc. Rhodesia Scient. Assoc.*, xxxii, pp. 65–79, 4 pl., 1933.

The author states that his comparative studies [details of which are given] have proved the existence of sufficient constant differences between the fungi comprising Haigh's A and C groups of *Rhizoctonia bataticola* [*R.A.M.*, ix, p. 685] to justify their separation into two distinct species. In the first place he points out that the group C (the pycnidial stage of which has been shown by Ashby to be *Macrophomina phaseoli*) is now recognized as a definite parasite of herbaceous plants and a facultative parasite of woody plants, while the A group has only been reported from trees, the authentic records being apparently on *Acacia* in Kenya, *Grevillea, Casuarina*, coffee, and *Hevea* rubber in Uganda, and *Citrus, Eucalyptus*, mango, *Pittosporum*, and *Pinus* in Rhodesia. Secondly, while *M. phaseoli* is typically associated with a rot of the fibrous or very small lateral roots, the A group occurs typically upon the large lateral and crown roots, a further distinction of the latter group being its ability to penetrate the core of large lateral roots well in advance of the disease in the bark. Parallel studies in culture of four isolations of group A (from orange, grapefruit, and *Hevea* rubber trees) and three isolations of *M. phaseoli* (from *Eucalyptus rostrata*, lemon, and lime) also showed constant distinctive characters of mycelium and sclerotia [which are described at length], permitting of their easy macro- and microscopical distinction, even after the fungi had been in culture for some time and had produced saltating strains which, on suitable treatment, were brought back to normal. It is stressed that throughout all the treatments to which the cultures were subjected, no indication of specific identity between the two groups was observed, though the microscopic structure of the sclerotium is essentially the same in both.

For all these reasons the author considers that the binomial *R. bataticola* should be retained solely for the sclerotial stage of *M. phaseoli*, and suggests re-establishing Small's name *R. lamellifera* [ibid., v, p. 451] for the fungi of the A group, producing sclerotia having an average diameter of about 0·5 mm. in culture and up to 1 mm. or more in the roots of woody plants. It is hoped, by this means, to do away with some of the confusion which has arisen from the promiscuous use of the name *R. bataticola* for all root-inhabiting fungi which produce the sclerotia characteristic of this group of fungi.

While the author has not yet studied in nature the fungi forming Haigh's B group, he can support the latter's statement that they retain their identity in culture, from his observations over a number of years of a *Hevea* strain supplied to him by Small.

Grainger (J.) & Heafford (Rachel M.). **Some effects of the ordinary Tobacco mosaic upon the developmental anatomy of the host plant.**—*Proc. Leeds Phil. Soc.* (*Scient. Sect.*), ii, 9, pp. 406–415, 4 figs., 1933.

This is a brief report of the authors' investigation of the effect on the developmental anatomy of the tobacco (Connecticut Havana

variety) leaf of ordinary tobacco mosaic (Johnson's No. 1 virus) [*R.A.M.*, xii, p. 398]. The results showed that whereas in the healthy young developing leaf vacuolation of the newly formed cells begins first around the region which is to form the midrib, and is followed by that of the future lamina, the effect of the virus in general is to delay the progress of vacuolation of cells of all tissues. In a somewhat later stage isolated groups of cells become vacuolate before the surrounding cells, instead of the normal regular progression of the process from tip to base. The work suggested that if the palisade cells reach complete vacuolation (which checks cell division) before the corresponding epidermal tissue, the result will be the formation of light green areas, while if the vacuolation of these cells is delayed (so that cell division continues longer) a dark green area will be formed, in which the palisade contains a greater number of smaller cells per unit area than in the light green parts. This increase in the palisade is responsible for the upward puckering of the dark green areas and also for the wavy contours of the vertical (side) walls of the epidermal cells of the upper surface which was observed in these areas. If vacuolation in all the tissues of a part of a mosaic-affected leaf proceeds at the same rate and in the same order as in healthy leaves, then no anatomical changes are produced in this part of the leaf.

It was further found that while 'vein-clearing' symptoms may be produced by direct inoculation into young leaves below about 3 cm. in length, no such symptoms are produced in larger leaves; the latter allow the virus to multiply and to spread to the smaller developing leaves which then exhibit the characteristic mottle.

It seems possible to explain the various anatomical features in mosaic tobacco leaves by differences in the relative succession of vacuolation in the several tissues in different areas of the leaf.

KOSTOFF (D.). **A contribution to the sterility and irregularities in the meiotic processes caused by virus diseases.**—*Genetica*, xv, 1–2, pp. 103–114, 15 figs., 1933.

The writer's observations at Leningrad on the female sterility virus of tobacco have already been summarized from another source [*R.A.M.*, xii, p. 600].

Partial sterility in tobacco (*N. tabacum* var. *macrophylla*) and in *Nicotiana triplex* (*N. tabacum* × *N. sylvestris* × *N. rusbyi*) may also be caused by severe mosaic infection, involving a disturbance in the reduction division of the pollen mother cells of some of the floral buds. A relatively high percentage (sometimes up to 50 per cent.) of abortive and abnormally large pollen is then formed, with an excessive number of chromosomes. Details are given of the meiotic processes observed in *N. tabacum* var. *macrophylla*.

Not only may different buds of the same branch be affected to a varying extent, but even various anthers of the same bud. In one flower, for instance, one anther contained 8 per cent. abortive pollen, two 18 per cent., and the remaining two 25 per cent. In very severe cases the flowers set a much smaller amount of seeds than those from normal plants (only 84 in one badly diseased capsule compared with a maximum of 800 in healthy ones).

The writer believes that severe infection of the reproductive organs may initiate certain mutative processes. The abnormalities in the reduction division of mosaic tobacco plants are doubtless connected with metabolic disturbances caused by the virus.

BÖNING (K.). **Zur Biologie und Bekämpfung der Sklerotienkrankheit des Tabaks (Sclerotinia sclerotiorum [Lib.] Massee).** [On the biology and control of the sclerotial disease of Tobacco (*Sclerotinia sclerotiorum* [Lib.] Massee).]—*Phytopath. Zeitschr.*, vi, 2, pp. 113–175, 3 figs., 1 diag., 2 graphs, 1933.

A full account is given of the writer's laboratory and field investigations on the biology and control of *Sclerotinia sclerotiorum* in the Bavarian tobacco fields [*R.A.M.*, vii, pp. 546, 548; x, p. 563], where heavy losses have been caused of recent years by this fungus.

The viability of the sclerotia was found to vary considerably according to the weather conditions prevailing at the time of their production, and also with the mode of overwintering, those kept in the soil usually germinating better than those stored in the laboratory. In the summer of 1931 apothecia were obtained from sclerotia kept under dry conditions since 1927, a year of particularly good viability. Medium-sized sclerotia (0·4 to 0·5 cm.) produced a larger number of apothecia than either the very small (below 0·4 cm.) or very large ones (0·5 to 1 cm. and above), the latter being specially poor in reproductive capacity. Apart from the sclerotia weakened by age or unsuitable methods of storage, all those formed on tobacco plants were induced to germinate, but a large number obtained on carrots by inoculation with two pure cultures of *S. sclerotiorum* from tobacco failed to develop apothecia. Sterility may sometimes be due to insufficiency of oxygen in the culture vessels. Soil temperatures between 15° and 25° C. are generally necessary for sclerotial germination. An absolute water content of the soil above 6·5 per cent. is further requisite for germination, and considerable practical importance attaches to the fact that a protracted dry spell of a month or so, resulting in the desiccation of the sclerotia, retards their germination for at least three to four weeks. Apothecial formation was favoured by the presence of humus in the soil, but hydrogen-ion concentration appeared to have little effect on the process. Germination is most profuse in the uppermost soil layers and in moderately well-shaded sites. The sclerotia of *S. sclerotiorum* are liable to infection by *Cephalothecium* [*Trichothecium*] *roseum*, which may play quite an important part in the reduction of infective material in the soil during seasons of alternating dry and wet periods.

The ascospores of *S. sclerotiorum* were found to be capable of spreading infection in the field over a distance of some 45 m. The mycelium appears to be of little or no importance in the perpetuation of the disease [cf. ibid., ix, p. 655].

Nutrition experiments showed a temporary beneficial effect from an excess of nitrogen, correlated with the retardation of growth in the treated plants and ceasing with renewed development. Under field conditions the health of the crop is most likely to be promoted

by a restricted use of nitrogen coupled with heavy applications of potash.

As a rule the sclerotial disease makes its first appearance in August, when the plants have attained their full development; its severity or otherwise is conditioned by the character of the weather during the preceding two months. Should the last protracted dry spell be longer than three to four weeks ago, sclerotial germination and consequent infection may be expected, whereas if the first half of July or longer is predominantly dry, apothecial development will not immediately take place, as indicated above, even under the influence of heavy rain.

The subject of control is discussed at length. There seems to be little prospect of successful breeding for resistance, and the disease must therefore be primarily combated by cultural measures [which are fully explained], supplemented where necessary by the application of calcium cyanamide to the soil, soil disinfection of small plots with 5 to 10 per cent. formalin, 10 to 20 per cent. carbolineum, or strewing with flowers of sulphur, and spraying with 2 per cent. Bordeaux mixture or other copper-containing fungicides.

AINSWORTH (G. C.). **Virus disease investigations. (a) Spotted wilt of Tomatoes. (b) Mosaic and 'stripe' disease of Tomatoes.**—*Eighteenth Ann. Rept. Cheshunt Exper. & Res. Stat., Hertfordshire, 1932*, pp. 39–45, 1933.

In 1932, tomato plants affected with spotted wilt [*R.A.M.*, xii, p. 59] were received from several widely separated places in Great Britain. The disease now appears to be of frequent occurrence and liable to cause considerable losses to growers of tomatoes and other plants; in the past it has probably been confused with stripe disease [ibid., xi, p. 679].

The symptoms produced on inoculated tomatoes [cf. ibid., iii, p. 307; xi, p. 549] consist in a sudden bronzing of the young leaves in irregular spots, circles, or rings, accompanied by an almost complete cessation of growth. In young plants the young leaves curl downwards and inwards. Affected plants though stunted are seldom killed unless attacked in the seedling stage. Under good growing conditions growth may recommence 10 to 15 days after the initial bronzing, often owing to the development of lateral shoots, but bronze markings usually develop later, and the shoots die back. Recovery was not observed. The virus was not detected in ripe fruits, but its presence was demonstrated in green ones.

The additional hosts determined by inoculation were tobacco, *Nicotiana macrophylla*, *N. glutinosa*, *Datura stramonium*, *Solanum capsicastrum*, garden petunias, dahlias, and nasturtiums (*Tropaeolum majus*). Cinerarias and chrysanthemums were found naturally infected, the latter in a nursery where in the previous spring tomatoes had been severely attacked. The most important agent of natural spread is *Thrips tabaci* [ibid., xi, p. 550], but being transmissible by juice inoculations the disease can also be spread by the hands and pruning knife, though it is less infectious than tomato mosaic. Infective juice was inactivated by filtering through Pasteur-Chamberland filters even when the operation was completed in 45 minutes, after which period unfiltered juice becomes inactive.

Control measures suggested consist in keeping tomato plants as free as possible from insects, especially *T. tabaci*, roguing out plants directly they become affected, and eradicating the alternate hosts, especially those in which the virus can overwinter.

Further investigation of tomato stripe [ibid., xi, p. 679] showed that some relation exists between it and a form of mosaic, for after outgrowing stripe tomatoes often are mottled. Stripe symptoms may be due to a bacterium (*Bacillus lathyri*) [loc. cit.], a single virus, or a mixture of viruses, and the methods of control differ with each type. Plants affected by stripe due to *B. lathyri* or to a single virus ('glasshouse streak') [ibid., x, p. 64; xii, p. 540] tend to outgrow the attack when treated with potash applications though these have no effect on mixed virus stripe, against which nitrogenous applications are indicated.

The commonest form of tomato mosaic in the British Isles is 'ordinary' or 'mild' mosaic. Material obtained from Cheshunt Experimental Station and several commercial nurseries was identical as regards filterability, host range, and resistance to ageing, heat, and chemicals with authentic tobacco mosaic (Johnson No. I) [ibid., xii, p. 582]. On tomato the incubation period varies from five days in summer to three weeks in winter. In spring and summer an attack results in a mild to moderately severe dark green mottle with slight leaf distortion and stunting; there is no necrosis and the fruit is not marked. In winter no mottling appears but stunting and leaf distortion are more marked than in summer; the 'fern leaf' type of symptom develops and anthocyanin is present in the stem.

Tomato plants affected with single-virus stripe (glasshouse streak) were obtained from a wide area either alone or mixed with tomato mosaic or, more rarely, with spotted wilt. The virus resembles that of mild mosaic in filterability, ageing *in vitro*, and resistance to heat and chemicals; the host range is also similar, but on some hosts the symptoms caused by the two viruses are readily distinguishable. The only symptom of glasshouse streak on tomato may sometimes be a mottle indistinguishable from that caused by tomato mosaic, but when mixed the two viruses retain their individual properties. Passage through tobacco filters out the glasshouse streak from this mixture in certain cases when the latter only causes local lesions and does not become systemic.

The form of stripe ('streak') due to a mixture of viruses [ibid., xi, p. 679] is rare in English glasshouses. It is typically the result of a mixed infection of tomato mosaic and potato mosaic, and can readily be synthesized and analysed. By inoculation of *N. glutinosa* the potato mosaic component can be isolated separately, as it alone becomes systemic; the longevity of the mixed virus *in vitro* is six months, after which the potato mosaic component becomes inactive.

READ (W. H.). **Physiological investigations of mosaic diseases of the Tomato.**—*Eighteenth Ann. Rept. Cheshunt Exper. & Res. Stat., Hertfordshire, 1932*, pp. 45–48, 1933.

Further investigation into the effect of aucuba mosaic upon the composition of the tomato plant [*R.A.M.*, xi, p. 678] demonstrated that about a week after inoculation the diseased plants contained

(in the evening) rather more reducing sugar than the controls, though after twelve hours' darkness the former generally showed an increase and the latter a decrease in the amount of reducing sugar present. The amount of non-reducing sugars present showed a similar overnight difference.

The mean sugar contents of the healthy and inoculated plants showed little difference during the first three weeks after inoculation, partly owing to dull weather. When brighter weather set in the inoculated plants developed typical yellowing and a remarkable increase in reducing sugars as compared with the controls, but after twelve hours' darkness the position was reversed; a similar, though less pronounced effect was produced on the non-reducing sugars.

During the dull weather the diseased plants contained more starch than the healthy ones, but the reverse was the case during the subsequent bright period.

From the eleventh day after inoculation the diseased plants contained rather more nitrogen than the controls, though up to that time there was no appreciable difference.

**Downy mildew on Tomato and Pepper.**—*Plant Disease Reporter*, xvii, 5, pp. 37–39, 1933. [Mimeographed.]

Pepper [*Capsicum annuum*] and tomato plants were observed by B. B. Higgins in Georgia to be infected by a fungus indistinguishable from the tobacco downy mildew (*Peronospora hyoscyami*) [see above, p. 679] in April, 1933. During 1931 a disease due to a *Peronospora* which they regarded as identical with *P. hyoscyami* was detected by R. F. Poole and F. A. Wolf on tomatoes in North Carolina, while in 1932 G. M. Armstrong investigated an infection of pepper plants in South Carolina which appeared to be due to *P. hyoscyami*, though it might have been *Phytophthora capsici* [*R.A.M.*, xii, p. 535]. Tobacco was infected by downy mildew in all three States.

**Wilt-resistant Tomatoes.**—*Fruit World of Australasia*, xxxiv, 6, p. 330, 1933.

In the market gardens of New South Wales tomato wilt due to *Fusarium* [*lycopersici*] is being well controlled by growing resistant varieties. The Department of Agriculture is arranging for the distribution of seed of the resistant strain of the Marglobe variety [*R.A.M.*, x, p. 416]. Among the most resistant varieties tested, a new one, Pritchard, ranked with Marglobe and Break of Day. The cross, Earliana, obtained from the highly resistant Red Currant Tomato, was grown to the third generation and showed individuals of promise. The most promising variety for glasshouse purposes at present is M.C. from Palestine.

JERMIESS. **Bekämpfung der Braunfleckenkrankheit der Tomaten mit Hilfe des Schwefelvernebelungsapparates 'Sulfurator'.** [Control of Tomato leaf mould with the aid of the sulphur vaporization apparatus 'Sulfurator'.]—*Obst- und Gemüsebau*, lxxix, 6, pp. 89–90, 1933.

Practically complete control of tomato leaf mould [*Cladosporium*

*fulvum*] is stated to have been obtained in 1932 in the market-gardening district of Vierlande [Hamburg] by sulphur fumigation of the glasshouses (at intervals of three weeks from the beginning of June to the end of August) with the Sulfurator apparatus [*R.A.M.*, xii, p. 642]. In neighbouring untreated houses the plants were severely attacked and many died prematurely. The apparatus had originally been purchased to combat rose mildew [*Sphaerotheca pannosa*], against which it proved thoroughly effective.

CHAMBERLAIN (E. E.). **Blossom-end rot of Tomatoes. Its appearance, cause, and preventive treatment.**—*New Zealand Journ. of Agric.*, xlvi, 5, pp. 293–296, 2 figs., 1933.

Both in the glasshouse and in the field the most serious fruit rot of tomatoes throughout New Zealand is blossom-end rot [*R.A.M.*, xi, pp. 26, 698]. The disease appears to be due to lack of soil moisture. In the field it generally occurs on light, sandy soil and is often confined to dry, sandy or gravelly ridges. The heaviest losses are sustained in vigorous, sappy plants irrigated and then left without water. Vigorous plants became affected when removed from a shaded to an unshaded glasshouse, though similar plants left in the shaded glasshouse remained unaffected.

Preventive measures consist in providing an adequate, regular supply of water, especially after the fruit has started to develop, ensuring steady growth, and avoiding forcing, especially where dry conditions are expected during fruiting. Nitrate of soda should be used as a nitrogenous fertilizer instead of sulphate of ammonia or blood manure. Glasshouses should be whitewashed to afford shade, and in the field sandy soils and ridges should be avoided.

A bibliography of 10 titles is appended.

BEATTIE (R. K.). **Diseases threatening ornamental and forest trees.**—*Journ. Econ. Entom.*, xxvi, 3, pp. 621–624, 1933.

Briefly recapitulating the outlines of his paper (in collaboration with W. A. Orton) on the biological basis of foreign plant quarantines [*R.A.M.*, iii, p. 111], the writer cites a number of diseases threatening American ornamental and forest trees, the early detection and control of which require the zealous co-operation of pathologists, mycologists, and nursery inspectors.

In 1930, 302 specimens were cultured at Wooster, Ohio, under the supervision of C. May to determine the presence or absence of elm disease (*Graphium* [*Ceratostomella*] *ulmi*); in 1931, 600; and in 1932, 453 (representing 19 different States in the last-named year) [ibid., xii, p. 404].

In connexion with studies by G. G. Hahn on larch canker (*Dasyscypha willkommii*) [*D. calycina*: ibid., ix, pp. 90, 501], it has been ascertained that *D. ellisiana*, normally saprophytic on pine in the eastern seaboard States and unknown west of the Alleghanies, has become a parasite of Colorado Douglas fir [*Pseudotsuga taxifolia*] introduced into Rhode Island.

No fresh sites of Scotch pine [*Pinus sylvestris*] infection by Woodgate rust (*Peridermium* sp.) [ibid., x, p. 83] have been detected recently.

H. H. York has observed a canker disease, characterized by copious resin exudations, severely attacking the crowns and upper roots of red and white pines [*Pinus resinosa* and *P. strobus*] in New York plantations (*Journ. of Forestry*, xxx, p. 505, 1932). The cause, place of origin, and extent of the disease are still unknown.

The needle blight of [Colorado] firs [*Abies concolor*] due to *Rehmiellopsis bohemica*, recently described from Massachusetts by Alma M. Watermann and M. A. McKenzie [ibid., xii, p. 408], has since been recorded from three localities in Maine and five in New York.

BUISMAN (CHRISTINE). **Iepencultuur en Iepenziekte in Italië.**—[Elm cultivation and Elm disease in Italy.]—*Nederl. Boschbouw-Tijdschr.*, vi, 5, pp. 147–152, 4 figs., 1933.

Besides being extensively planted along the streets, elm trees in Italy find two important secondary uses, namely, the trunks as vine supports (especially in the province of Emilia) and the foliage as fodder for stock. The occurrence of the elm disease (*Graphium* [*Ceratostomella*] *ulmi*) [*R.A.M.*, xii, p. 404] is, therefore, of considerable importance. In Tuscany *Acer campestre* is used for vine supports in place of elms, and an attempt is being made to substitute the former for the latter in the Bologna district, where infection by *C. ulmi* has made rapid progress during the last four years and involves 25 per cent. of the elm supports in some vineyards. *A. campestre*, however, is attacked near Bologna by *Verticillium albo-atrum* [ibid., xi, pp. 411, 755; xii, p. 470], so that doubts are felt as to the advisability of its introduction on a large scale. The insects primarily concerned in the transmission of the elm disease in Emilia have been identified as *Scolytus multistriatus* and *Pteleobius vittatus*.

The elm generally cultivated in Italy appears to be a susceptible species of the small-leaved *Ulmus foliacea* type, possibly var. *italica*, and the best prospect of eliminating the disease would appear to lie in its replacement by a resistant species, such as the so-called 'Siberian' elm (*U. pumila* var. *pinnato-ramosa*) [ibid., xii, p. 665], a consignment of which has been procured from the United States for testing at a Bologna nursery.

TROUP (R. S.). **Some problems of British forestry.**—British Science Guild, 13 pp., 1933.

Among the problems of British forestry briefly outlined in an address before the British Science Guild on 19th June, 1933, mention was made of the extensive losses reported to be caused by *Stereum spadiceum* among oaks in the Forest of Dean. The fungus enters the trunks of the trees through dead branches and produces a heart rot that ultimately destroys the whole interior.

SEMPIO (C.). **Sulla progressiva distruzione delle alberate di Platani in alcune zone dell' Italia Centrale.** [On the progressive destruction of Plane trees in certain regions of Central Italy.]—*Riv. Pat. Veg.*, xxiii, 3–4, pp. 129–170, 7 pl., 1933.

For some years *Platanus occidentalis* in central Italy, particu-

larly in Perugia, has been attacked with increasing severity by *Gnomonia veneta* [*R.A.M.*, viii, p. 76], the hard winter of 1929 especially predisposing the trees to attack. Some of the trees are already dead and others dying. A detailed study was made of an outbreak in 1932.

The conidial stage, *Gloeosporium nervisequum*, appeared on the leaves in May after a dense mist, causing considerable defoliation, and it was observed that the moderately sized branches bore, especially towards the apex, irregular woody swellings often so covered with short twigs as to resemble witches' brooms. Cone-shaped or irregular nodules also sometimes formed on the thick branches and trunk.

In most cases attack on the branches appeared to arise from previously infected twigs, the infection of the latter being at the nodes, where a brownish lesion developed and spread to the cambium. The mycelium was difficult to observe in the living tissues but developed extensively after the death of the tissues, especially in the pith and xylem. Attack took place at the end of winter, presumably from overwintered pycnospores of the *Discula platani* stage of the fungus, or possibly from the ascospores. It spread down to the branch bearing the twig, penetrating the cambium and wood of the branch and leading to localized hypertrophy of the latter, presumably by the action of some toxic substance. The swellings contained much distorted vascular and woody tissue, a great part of their cells was occupied by a reddish brown substance, and the part of the branch beyond them was frequently killed. The smaller nodules found on the large branches, sometimes very closely crowded, are considered to be due to localized infections also arising from killed-back twigs.

The leaf form of the fungus, *G. nervisequum*, always developed, in the author's experience, soon after the attack on the twigs. As infection of the woody parts constitutes a permanent focus for the parasite, the author recommends the pruning out of all diseased branches.

Extensive studies of the biology of the fungus are reported. It proved readily cultivable from the *Discula* stage, the optimum development occurring at 15° to 16° C., and the pycnidia maturing in 9 or 10 days.

Inoculations on seedlings with the pycnospores or conidia gave generally unsatisfactory results but in two cases with the former successful infection was secured. In one of these a two-year-old seedling was successfully infected through the leaves and tips of the branches and acervuli of *G. nervisequum* developed on the former. In the other a lateral branch was infected and died back to the node next below but bore no fructifications, though the leaves on it developed acervuli as before. The incubation period was about a month.

A bibliography of 32 titles is appended.

**Gesetze und Verordnungen.** [Laws and regulations.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xiii, 6, p. 47, 1933.

GERMANY (SCHLESWIG-HOLSTEIN). A police regulation of 27th March, 1933 (effective 1st May) introduces certain modifications

into the barberry eradication order of 7th August, 1930 [against *Puccinia graminis*]. Under the present provisions, the growing of 14 species of *Berberis* (including *B. aetnensis*, *B. canadensis*, *B. fendleri*, and *B. vulgaris*, with its varieties) is prohibited within 200 m. of arable land. Wild barberries growing within this distance of cultivated fields are to be eradicated and destroyed by the owners of the land on which the plants occur.

**Southern Rhodesia. Act to provide for the suppression of Tobacco pests.**—66 pp., 1933.

The Tobacco Pest Suppression Act, 1933 (repealing that of the same title of 1931) defines the measures to be taken for the extermination of pests and diseases of cured and growing tobacco. Inspectors duly authorized by the Minister of Agriculture are empowered to enter tobacco plantations and to take the necessary steps for the eradication of any pests or diseases found thereon, including the destruction of growing tobacco plants (if self-sown or abandoned as useless) and of alternate hosts and weeds. By a given date each year growers must destroy all tobacco plants or stalks and alternate hosts (to be declared by the Governor) on their land, failing which the work will be carried out under the instructions of the Minister of Agriculture at the owner's expense. By Government Notice No. 367 (1 p., 9th June, 1933) leaf curl [*R.A.M.*, xii, p. 158] is scheduled under the Act, and the 1st August is fixed as the date by which destruction of growing tobacco plants is to be completed.

**Legislative and administrative measures. Argentine Republic.**—*Internat. Bull. of Plant Protect.*, vii, 6, p. 128, 1933.

By Presidential Decree of 22nd August, 1932, *Pseudomonas savastanoi*, the causal organism of bacterial tumours of the olive [*R.A.M.*, x, p. 46; xii, p. 458], has been declared an agricultural scourge.

**Packing materials quarantine. Amendment No. 1 to notice of Quarantine No. 69.**—*U.S. Dept. of Agric. Office of Inform. Press Service*, 2 pp., 1933. [Mimeographed.]

Amendment No. 1 to notice of Quarantine No. 69, effective as from 1st July, 1933, authorizes the admission into the United States of certain common packing materials, prohibited from entry under the Quarantine, e.g., rice straw, maize and allied plants, cotton and cotton products, sugar-cane, bamboo, plant leaves, forest litter, and soil [*R.A.M.*, xii, p. 464], provided they have been prepared in such a way that, in the judgement of a qualified inspector, no risk of pest introduction is involved.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
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R. (H.). **Comment on combat la maladie de l'Orme en Hollande.** [How Elm disease is fought in Holland.]—*Bull. Soc. Centr. Forest. Belgique*, xl, 5, pp. 213–215, 1933.

In this account of the Dutch measures against the elm disease caused by *Graphium* [*Ceratostomella*] *ulmi* [*R.A.M.*, xii, p. 734], it is stated that by Royal Decrees of 18th April, 1930, and 28th March, 1931, the Dutch forestry and phytopathological services are empowered to search for elms affected by it and to decide, as far as possible with the consent of the grower, which trees must be cut down. The proprietor is then notified officially that the trees are to be removed by a certain date and in accordance with certain conditions. The fulfilment of these requirements is supervised by the local burgomaster, who in cases of non-compliance issues a summons and, if necessary, causes the prescribed measures to be effected at the owner's expense. After removal, the trees must either be barked at once or kept in water for three months to prevent further dissemination by the bark *Scolytus* beetles. Under these regulations over 26,000 elms were cut down in 1931.

All research work on the disease is controlled and directed by a Government Commission working in collaboration with the Willie Commelin Scholten phytopathological laboratory and the Wageningen entomological station [ibid., xii, p. 541].

The paper concludes with brief details of the large-scale resistance trials of elm species and varieties at present in progress in Holland [ibid., xii, p. 665].

TUBEUF [C. v.]. **Studien über Symbiose und Disposition für Parasitenbefall sowie über Vererbung pathologischer Eigenschaften unserer Holzpflanzen. II. Dispositionsfragen für den Befall der Bäume durch Pilze und Käfer. III. Untersuchungen über Zuwachsgang, Wassergehalt, Holzqualität, Erkrankung und Entwertung geharzter Fichten.** [Studies on symbiosis and tendency to parasitic infection and on the inheritance of pathological characters in our woody plants. II. Questions on the liability of trees to fungus and beetle attack. III. Investigations on incremental growth, water content, wood quality, disease, and degeneration of Spruces

denuded of resin.]—*Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz*, xliii, 6, pp. 257–357; 7, pp. 369–417, 27 figs., 2 diags., 1933.

The conclusion reached by the writer, as the result of exhaustive and fully documented and tabulated studies on the connexion between the extraction of resin from conifers and infection by wood-destroying fungi, e.g., *Fomes annosus* on spruce and blue rot [*Ceratostomella* spp.] on pine [*R.A.M.*, xii, pp. 344, 345, 543, 545] in Germany, is that invasion by the pathogens is greatly favoured by this operation. The water-conducting sapwood dries out below the fissures made in the cortex for the extraction of the resin, and heavy losses of economically valuable timber from fungal attack ensue.

The remainder of the paper deals mainly with the conditions predisposing to insect attack.

HOPFFGARTEN (E. H. v.). **Beiträge zur Kenntnis der Stockfäule (Trametes radiciperda).** [Contributions to the knowledge of the butt rot (*Trametes radiciperda*).]—*Phytopath. Zeitschr.*, vi, 1, pp. 1–48, 6 figs., 1 diag., 1933.

A comprehensive account is given of the writer's detailed laboratory and field studies on the butt or red rot of spruce and pine in Germany caused by *Trametes radiciperda*, a name preferred by the author to the more commonly used *Fomes annosus* [see preceding abstract], because the fungus described under the name *Polyporus annosus* in Fries's 'Epicrisis' in 1838 appears to be quite distinct from Hartig's *T. radiciperda* and the latter is regarded as a good *Trametes*. Gaps in the stands were found to occur chiefly in soils with a $P_H$ range of 4·6 to 6, i.e., near the optimum reaction for the growth of the fungus. By culturing the fungus on wood blocks from different situations, a connexion was traced between its occurrence and the abundant nitrogen content of reafforested arable land, which induces a loose, spongy texture in the wood and affords plentiful nutriment for the mycelium. Culture experiments further showed the necessity of a high moisture content in the wood for the optimum development of *F. annosus*, this requirement being also met on the reafforested arable areas. Nitrogen compounds of high molecular weight were particularly well utilized by the mycelium.

A consideration of the physical structure of the soil gives a clue to the apparently erratic incidence of *F. annosus* on grassland, an essential condition being the finely granulated texture characteristic of loess and loess-clay soils, in which the density leads to the death of the roots at a depth of 20 to 30 cm. and so facilitates infection. Other factors involved in the development of the fungus are the shape of the soil particles, and the ground water and subsoil conditions, so that even on soils of appropriate texture the incidence of attack may be very unequal. Permanently moist sites are not invaded by reason of the absence of aeration, but infection is prevalent on temporarily damp areas.

No exact information is available with regard to the mode of spread of the fungus in the soil, though root contact, especially at a depth of 8 to 12 inches, undoubtedly plays a part. It is ques-

tionable whether absolutely sound roots can be penetrated by *F. annosus*, the inference being rather that infection spreads from the deeper roots to the butt and to the root system in the upper soil layers, already weakened by an unsuitable environment. No evidence of wound infection by spores could be obtained and in most of the isolations from wounded areas on the roots examined, other fungi than *F. annosus* were obtained. Red rot following wounds appears to be mostly due to *Polyporus borealis* [*R.A.M.*, iii, p. 491; v, p. 267] and other wound parasites.

The author's observations did not indicate that in the areas concerned *F. annosus* was a secondary infection to that caused by *Agaricus melleus* [*Armillaria mellea*: ibid., x, p. 354].

DETWILER (S. B.). **General aspects of the White Pine situation.**—*Journ. of Forestry*, xxxi, 5, pp. 514–521, 1933.

In connexion with a general survey of the white pine (*Pinus monticola*, *P. strobus*, *P. lambertiana*, *P. flexilis*, *P. strobiformis*, *P. albicaulis*, *P. aristata*, and *P. balfouriana*) situation in the United States, the writer (representing the Society of American Foresters) emphasizes Federal responsibility for the protection of the 20,000,000 acres occupied by forests of these trees from blister rust [*Cronartium ribicola*: *R.A.M.*, xii, p. 604]. The fungus was first found established in the native pine stands of New England in 1915, and by 1932 at least 15,000,000 acres of forest had been attacked, of which 6,000,000 were receiving protection in the shape of *Ribes* eradication. From 1918 to 1931, a total of 115,897,609 *Ribes* bushes were destroyed at a cost of 83 cents per acre, of which 17 per cent. was provided out of Federal funds.

MACTAVISH (Miss J.). **Wood-destroying fungi: a biological study of dry rot (Merulius lacrymans).**—*Journ. Roy. Techn. Coll.*, Glasgow, iii, 1, pp. 191–199, 12 figs., 1933.

A study was made of the life-history of the dry rot fungus (*Merulius lacrymans*) [*R.A.M.*, xii, pp. 258–260], and descriptions are given of the external and microscopic characters of the various phases of the organism, which was successfully cultured on different artificial media and on sterile wood. The conditions favouring growth occur, especially, in structural timber adjoining the exterior walls of buildings. The organism was found to be actively water-absorbent and capable of conducting water from one place to another, and in ill-ventilated places with stagnant air the atmosphere quickly becomes damp owing to the moisture exuded from the surface mycelium.

WIERTELAK (J.). **The effect of decay caused by white rot fungi on the chemical composition of wood.**—*Bull. Internat. Acad. Polonaise, 1932*, B, 1, pp. 19–36, 1932. [Abs. in *Chem. Abstracts*, xxvii, 16, p. 3973, 1933.]

A sample of naturally decayed Douglas fir [*Pseudotsuga taxifolia*] wood infected by *Trametes pini* showed a decrease in the percentage lignin content from 29·9 to 22·4, accompanied by an increase in cellulose from 52·2 to 60, compared with the non-infected portion of the same board [*R.A.M.*, xii, p. 343]. Sawdust

samples from heartwood and sapwood of loblolly pine [*Pinus taeda*] and white fir [*Abies pectinata*] were inoculated with *T. pini* and *Polystictus hirsutus* [ibid., x, p. 217], the loss in weight determined, and chemical analyses made in the early stages of decay. The maximum loss in weight (15·3 per cent.) was obtained with *P. taeda* sapwood infected by *T. pini*. In general, the white rot decay results in a marked decrease of lignin coinciding with a slow consumption of cellulose, which appears to be more rapidly attacked by *P. hirsutus* than by *T. pini*.

CARTER (D. G.), BARR (H. T.), & WOOD (J. B.). **Durability of posts, and results of preservative treatment.**—*Arkansas Agric. Exper. Stat. Bull.* 287, 16 pp., 1 fig., 1 graph, 1933.

The writers discuss and tabulate the results of their field and laboratory experiments on the preservation of oak (*Quercus rubra*) and pine (*Pinus echinata*) for fence posts by various standard treatments directed against the wood-destroying fungi, *Fomes annosus*, *Lentinus lepideus*, and *Lenzites sepiaria* [*R.A.M.*, xi, p. 617 *et passim*].

Pine posts creosoted by the pressure process in a commercial plant were entirely sound after ten years' service [ibid., xii, p. 1], while the home creosote treatment of oak posts (open tank, hot and cold bath) gave an apparent increase of about four years in durability, 50 per cent. being in good condition after ten years. Creosote was the most generally effective of all the preparations tested, but promising results were also given by undiluted used motor oil (short treatments at relatively low temperatures), zinc chloride, molten sulphur, copper aceto-arsenate, copper arsenite, and copper borate.

**Cabbage yellows.**—*New Jersey Agric. Exper. Stat. Circ.* 283, 2 pp., 1933.

A popular note is given on the symptoms, life-history, and control of cabbage yellows (*Fusarium conglutinans*) [*R.A.M.*, xii, p. 608] in New Jersey, with special reference to the cultivation of resistant varieties.

BREMER (H.). **Die Brennfleckenkrankheit der Erbse.** [Pea anthracnose.]—*Mitt. Deutsch. Landw.-Gesellsch.*, xlviii, 22, pp. 489–490, 1 fig., 1933.

Anthracnose of peas (*Ascochyta pisi*) [*R.A.M.*, xii, p. 483] does not ordinarily occur in a very virulent form in Germany, but recently attention has been directed towards this disease, which may destroy entire stands when the plants are attacked at an early stage. It is uncertain whether the other two fungi associated with pea anthracnose in the United States [*Mycosphaerella pinodes* and *A. pinodella*: ibid., vii, p. 611 *et passim*] also participate in the causation of the disease in Germany. Seed disinfection does not control the serious type of seedling disease which results from internal seed infection and which may be difficult or even impossible to detect outwardly. Care should, therefore, be taken to use seed from healthy crops.

ZAUMEYER (W. J.) & WADE (B. L.). **Mosaic diseases affecting different legumes in relation to Beans and Peas.**—*Phytopath.*, xxiii, 6, pp. 562–564, 1933.

The viruses causing mosaic of white and yellow sweet clover (*Melilotus alba* and *M officinalis*), white clover (*Trifolium repens*), lucerne, peas, and sweet peas are all transmissible to beans (*Phaseolus vulgaris*) [*R.A.M.*, xii, p. 615], while that producing red clover (*T. pratense*) mosaic is not [cf. ibid., ix, p. 121]. On inoculation into beans, the white and *M. alba* viruses induce symptoms of which some resemble the typical mottled and chlorotic condition of common bean mosaic. All the bean-infecting legume mosaic viruses cause systemic infection on beans, except that of lucerne, the lesions of which are purely local, while the white clover mosaic may also produce local as well as systemic injury. Hitherto only the bean mosaic has been found to be transmissible through the seed.

The lucerne mosaic virus infected 24 out of 28 bean varieties tested, that of white sweet clover 21 out of 22, that of white clover 24 out of 26, and that of peas 31 out of 32. The three bean varieties resistant to bean mosaic, namely, Robust, a strain of Great Northern, and a Stringless Green Refugee selection, are also resistant to lucerne mosaic. The *M. alba* and *T. repens* viruses infect the Stringless Green Refugee selection but not the others, while that of pea mosaic attacks both this selection and Robust. Only Great Northern appears to be resistant to all the viruses used.

A mosaic virus (designated as No. III), isolated from a bean hybrid, behaves similarly to the other legume viruses but differs from common bean mosaic. It is systemic but apparently not seed-borne [cf. ibid., xii, p. 614]. Of the 26 varieties inoculated with this virus 24 were susceptible, including Stringless Green Refugee, which is resistant to the common bean mosaic.

The red clover mosaic virus, on inoculation into peas, produced symptoms somewhat resembling those of pea mosaic but gave negative results on sweet peas. Neither peas nor sweet peas contracted infection from the lucerne and bean mosaic viruses, but those of *M. alba* and *T. repens* produced destructive symptoms, quite unlike those of pea mosaic but rather resembling streak, both on peas and sweet peas.

ZALESKI (K.). **Względna odporność na bakterjozę obwódkową odmian Fasol uprawianych w Polsce.** [Relative resistance to halo blight of Bean varieties grown in Poland.]—*Polish Agric. & Forest Annual (Roczniki Nauk Rolniczych i Leśnych)*, Poznań, xxx, 1, pp. 39–116, 4 pl., 1933. [English summary.]

After a comprehensive review of the work so far done in the investigation of halo blight (*Bacterium medicaginis* var. *phaseolicola*) of beans [*R.A.M.*, xii, p. 271], with particular reference to his own researches in America in collaboration with Burkholder [ibid., xi, p. 418], the author states that the disease, a detailed description of which is given, was discovered for the first time in Poland in 1931, causing considerable damage to field-grown beans (*Phaseolus* spp.) in the region of Poznań. Considerable details are given of 15 months' field and greenhouse tests of 144 distinct (not

counting synonyms) varieties (139 of *P. vulgaris* and 5 of *P. multiflorus*), mostly of Polish origin, for resistance to the disease, all the inoculation work having been done on the lines described in the previous communication [loc. cit.]. The results [presented in the form of tables] showed that of 135 dwarf varieties (some synonymous) tested only three (Szablasta, Zielono-strączkowa Hinricha, and Zuckerperl) were immune, while 18 were highly resistant, and the remainder varied from moderately to highly susceptible. Among the 57 pole varieties (including synonyms) of *P. vulgaris* seven proved to be immune and 29 highly resistant. No correlation was found between the colour (white or purple) of the flowers and resistance or susceptibility. While the investigation showed that *P. multiflorus* must be included in the host range of *Bact. medicaginis* var. *phaseolicola*, all the five varieties tested exhibited a high degree of resistance to the disease both in the field and in the greenhouse.

STAPP (C.). **Verfahren zur Prüfung von Bohnen (Phaseolus vulgaris) auf Resistenz gegen Pseudomonas medicaginis var. phaseolicola Burkh., den Erreger der Fettfleckenkrankheit.** [A method for the testing of Beans [*Phaseolus vulgaris*] for resistance to *Pseudomonas medicaginis* var. *phaseolicola* Burkh., the agent of grease spot disease.]—*Angew. Bot.*, xv, 3, pp. 241–252, 6 figs., 1933.

In order to improve the method of testing their reaction to the causal organism of grease spot disease (*Pseudomonas* [*Bacterium*] *medicaginis* var. *phaseolicola*) [see preceding abstract], bean (*Phaseolus vulgaris*) seedlings of the St. Andreas and Flageolet Rote Pariser varieties were immersed on emergence from the testa, in dilute suspensions of pure cultures of the organism. After 18 hours' immersion in flat dishes in moist chambers, the seedlings were removed, superficially dried by exposure to the air, and planted out in pots in a room with a relative atmospheric humidity of about 60 per cent. and a temperature about 20° C.

This method proved highly efficacious, resulting in a more generalized infection of the seedlings than was obtained by the less reliable methods of spraying the seedlings or inoculating them through needle pricks with a bacterial suspension.

MCCUBBIN (W. A.). **The Lima Bean scab situation.**—*Journ. Econ. Entom.*, xxvi, 3, pp. 625–630, 1933.

During the writer's visit to Cuba in March, 1931, evidence was obtained that the spores copiously produced by the scab (*Elsinoe canavaliae*) fungus on Lima bean [*Phaseolus lunatus*: *R.A.M.*, xi, p. 619] are wind-borne. In one field under observation 80 to 90 per cent. of the pods were infected, yet it was several years since beans had been grown on the site, and at the time of inspection the nearest were two miles distant. Local growers think that stormy weather increases the incidence of scab. The fungus is believed to persist during the period between two crops on living Lima bean plants, wild or escaped, left intact by poor ploughing, or in old fields remaining untouched throughout the summer. Dr. Bruner's experiments showed that numerous applications of a spray or dust

were necessary to ensure control. Various methods of destroying the scab fungus on Cuban Lima bean consignments to the United States are considered, of which the most feasible appears to be shelling at the place of origin.

Baehni (C.). **La septoriose (rouille) du Céleri et le Septoria petroselini Desm. var. apii, Br. et Cav.** [Septoriosis (rust) of Celery and *Septoria petroselini* Desm. var. *apii* Br. & Cav.]—*Bull. Soc. Bot. de Genève*, Sér. 2, xxiv (*1931–2*), pp. 1–57, 7 figs., 1933.

A very detailed account is given of the writer's laboratory and field studies at Geneva, Switzerland, on the celery disease caused by *Septoria petroselini* Desm. var. *apii* Br. & Cav. [*S. apii* Rostr.: *R.A.M.*, xii, p. 546], which under local conditions first appears in June and reaches a climax in September. It was found that 15 to 78 per cent. of the seeds in commercial seed samples are infected, secondary spread from the primarily infected seedlings being effected chiefly by rain splashing and contact. As the fungus rarely fructifies on the seedlings, secondary infection of the aerial parts usually only occurs after transplanting, but the author found that spread from root to root readily takes place and can lead to extensive infection in the seed-beds. Under experimental conditions in agar cultures of the seedlings root infection developed at the beginning of the fourth week after the inoculation of the seedlings with a suspension of the conidia. The roots turned brown and became enveloped by a mycelial sheath which progressed downwards towards the tip but did not generally involve the region of active root hair development. Near soil level this sheath (composed of very dark green hyphae, black in the mass) forms a dense coating. After some time the leaves begin to turn yellow and at this critical juncture two possibilities arise: either the plant reacts by the production of new roots and ultimately recovers, or under exceptional circumstances (4 out of 25 of the cases under observation) the feeding roots become disorganized and desiccation ensues in four or five days.

The aerial mycelium of *S. apii* was found to develop better on acid than on alkaline media. On Coons's agar growth was promoted by the presence of asparagin and levulose. Conidial growth reached a maximum in a slightly acid medium containing ammonium chloride, while pycnidia developed most profusely in the presence of potassium nitrate. The dissemination of the conidia of *S. apii* is most readily effected when the temperature remains at a constant high level for an appreciable period. At the same time, this condition favours the development of the host, whereas cool nights and misty days are adverse to the latter while stimulating the fungus. The maximum damage, therefore, may be expected during the early autumn.

The most susceptible varieties are the grand doré amelioré, blanc amélioré, and plein blanc doré, while plein blanc Lepage and vert maraîcher are comparatively resistant, especially the last-named. Promising results were obtained by seed treatment with sodium hypochlorite [cf. ibid., xi, p. 370].

NEILL (J. C.). **Celery spot and its control.**—*New Zealand Journ. of Agric.*, xlvi, 5, pp. 289–292, 3 figs., 1933.

After referring to the wide prevalence of celery blight (*Septoria apii*) [see preceding abstract] in New Zealand the author states that in a field trial with four varieties at Palmerston North a first-class disease-free stand was obtained from infected seed by dipping for ten minutes in water at 136° F., followed by plunging into cold water for two minutes and rapid drying, the seed then being stored in the ordinary way. Untreated seed from the same packets gave a heavily diseased crop. As this treatment reduces the germinability of one-year-old seed by about 10 per cent., and that of two-year-old seed by about 50 per cent., while it would probably kill older seed, only fresh seed must be used, and a preliminary, small-scale test should be made of the effect on germination. Brief notes are given on further sanitary precautions recommended.

ORCHARD (O. B.). **The control of Cucumber mildew.**—*Eighteenth Ann. Rept. Cheshunt Exper. & Res. Stat., Hertfordshire, 1932*, p. 48, 1933.

Although reasonably good control of cucumber mildew (*Erysiphe cichoracearum*) was given by shirlan paste with agral I as spreader [*R.A.M.*, xi, p. 679] the mixture had a hardening and slightly scorching effect on the plants. When agral N was substituted for agral I it had twice the wetting properties of the latter and the plants were not scorched.

To secure satisfactory control the cucumbers must be sprayed every three or four days during the first month of the attack and at weekly intervals afterwards. After each spray application the oldest leaves must be thinned out. It is essential that the leaves should be sprayed until they drip, otherwise there is not enough fluid present to penetrate and destroy the spore masses.

LEACH (J. G.). **A destructive Fusarium wilt of Muskmelons.**—*Phytopath.*, xxiii, 6, pp. 554–556, 1 fig., 1933.

Golden Osage muskmelons in Minnesota were severely injured in 1932 by a species of *Fusarium* closely resembling *F. niveum*, the agent of watermelon wilt [*R.A.M.*, xii, p. 418], but differing from the latter in its paler red or purple pigmentation on nutrient media, its abundant production of microconidia, and fewer, shorter macroconidia (24 to 45 $\mu$, as against 27 to 60 $\mu$ for the watermelon wilt organism). The two fungi showed marked differences in pathogenicity, muskmelons being completely resistant to the culture of *F. niveum* from watermelon and highly susceptible to that from muskmelon, whereas Kleckley Sweet watermelons behaved in an exactly opposite manner. The muskmelon fungus may be a physiologic form of *F. niveum* or may be a closely allied species. It is believed to have been present in the State for at least three years. At an advanced stage the diseased plants develop brown, necrotic streaks extending from the base for 2 ft. or more along one side of the stem and bearing masses of salmon-pink spores.

HOPFE (E.). **Sind vom Spargelrost befallene Spargelkulturen noch zu retten?** [Can Asparagus plantings attacked by Asparagus rust be saved?]—*Ratschläge für Haus, Garten, Feld*, viii, 6, pp. 84–85, 1933.

Directions are given for the control of asparagus rust [*Puccinia asparagi*: *R.A.M.*, xii, p. 336] in the Mark Brandenburg, Germany, by weekly applications of nosprasit 'O' [ibid., xii, p. 223], combined with thorough sanitation and the liberal use of a complete fertilizer. It is claimed that nosprasit 'O' is thoroughly effective against the rust.

VIDAL (J. L.). **Pour lutter contre la chlorose de la Vigne.**—*Journ. d'Agric. Prat.*, N.S., xcvii, 25, pp. 505–506, 1933.

Directions are given for the treatment of vine chlorosis by the usual methods and it is recommended that in highly calcareous soils, where chlorosis is apt to be very prevalent, the choice of lime-tolerant stocks should be carefully made. Among these are mentioned (in ascending order of tolerance) Riparia, 101–14, 3·306, 3·309, Rupestris du Lot, 34 E.M., 161–49, Aramon × Rupestris Ganzin No. 1, R. 31, C. 1,202 and 93-5, 41 B., 333 E.M., and Berlandieri × Colombard.

PETRI (L.). **Rassegna dei casi fitopatologici osservati nel 1932.** [Review of phytopathological records observed in 1932.]—*Boll. R. Staz. Pat. Veg.*, N.S., xiii, 1, pp. 1–73, 1 fig., 1933.

Several cases of wilting of grape vines have been recently observed in various places in Italy and Sardinia. In one of these a *Fusarium* tracheomycosis is considered to be responsible in soil that had been repeatedly used for many years for striking layers. In others the condition resembled the progressive loss of growth activity recently described by the writer [*R.A.M.*, xii, p. 418]. The roots remained healthy and no leaf roll was present. A necrosis of the wood and cambium spreading from the top of the stem downwards to the graft union was associated with the presence of a secondary mycelium in the xylem causing tyloses to develop in the vessels and the formation of a brown gum. In these cases the vines were grafted on American stocks, such as Rupestris du Lot and Aramon × Rupestris. In one vineyard evidence was obtained that the disease is able to spread slowly through the soil.

Olives in Liguria, Campania, and Sicily shrivelled up while still on the trees. The cortical parenchyma of the stalks, which were withered and exuded a gummy substance, showed the presence of *Macrosporium oleae* [ibid., iii, p. 324], which is considered to be a weak parasite. In culture a perithecial stage determined as *Pleospora herbarum* was obtained.

Banana inflorescences from Eritrea showed a brown discoloration and mould of the bracts; the necrosed tissues contained *Nigrospora sphaerica* and *Stachylidium theobromae* [ibid., xi, p. 765], but the parasitism of these organisms was doubtful, both being regarded as usually saprophytic. Bananas from the same locality, rotted at the apex as a result of weather conditions, showed the presence of *S. theobromae* in the affected tissues.

The bacterial disease of figs due to *Bacterium fici* Cav. [ibid., iii, p. 524] occurred in the vicinity of Rome.

The leaves of mandarins (*Citrus* [*nobilis* var.] *deliciosa*) growing in Liguria showed typical 'greasy spot', apparently due to physiological disturbances set up through excessive pruning or unfavourable weather [cf. ibid., xi, p. 698].

Citrus fruits in Sicily were attacked by *Sclerotinia sclerotiorum*, *S. fuckeliana*, *Glomerella cingulata*, *Pleospora herbarum*, *Limacinia penzigi* [*L. citri*: ibid., iii, p. 211], and *Septoria citri* var. *minor*; *Phomopsis cytosporella* caused stem-end rot of lemons. The section on citrus diseases concludes with a detailed discussion of various disorders due to insect attack, non-parasitic spotting, sclerosis of orange rind, creasing or puffing of oranges [ibid., xi, p. 104], oleocellosis [ibid., x, p. 24], irregular brown spot of oranges, internal decline of lemons [ibid., xii, p. 214], hollow core, cold storage spots, gum spots on mandarin oranges, and mechanical injury caused to lemons by scraping against the branches.

A serious root rot of chestnut seedlings growing near Rome was caused by a *Pythium*. From small cankers at the forking of young withered branches of *Quercus ilex*, *Diplodia amphisphaeroides* was isolated and is considered to be responsible for the condition though hitherto known only as a saprophyte on the dead bark of oaks. On the young branches of *Coffea arabica* from Eritrea affected by a withering of the tips, the author found perithecia differing from those of *Anthostomella coffeae* to which Delacroix attributed an apparently identical condition, as well as an *Ascochyta*, probably forming part of the life-cycle of the perithecial fungus.

Maize growing in an experimental plot near Rome developed a striped chlorosis resembling streak [ibid., xii, p. 143] and regarded as probably a deficiency disease. *Cicer arietinum* in the vicinity of Cosenza was appreciably damaged by collar and root rot due to *Rhizoctonia violacea* [*Helicobasidium purpureum*]. Much injury was caused to cotton (especially 10- to 12-day-old seedlings) in Eritrea as a result of attack by *Bact. malvacearum* [ibid., x, p. 775].

Braun (K.). **Tätigkeitsbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, Zweigstelle Stade, für die Zeit von 1. April 1932 bis 31. März 1933.** [Report on the work of the National Biological Institute for Agriculture and Forestry, Stade Branch, for the period from 1st April, 1932 to 31st March, 1933.]—Reprinted from *Altländer Zeit.*, Jork, 94, 98, 102, 106, 110, 114, 7 pp., 1933.

The following are amongst the items of phytopathological interest occurring in this report. Notwithstanding the varying times of maturation and ejection of the *Fusicladium* [*Venturia inaequalis* and *V. pirina*] ascospores in the spring of 1932, nearly all apple and pear varieties in the North German districts under observation contracted a sudden attack of scab during the early part of June, attributable to infection in the wet weather at the end of May. The current year's apple seedlings in a breeding plot were infested by mildew [*Podosphaera leucotricha*: *R.A.M.*, xii, p. 517] to an

extent unparalleled in the Stade district; a few pears were attacked by the same fungus [ibid., x, p. 247].

No increase in the resistance of celery to *Septoria apii* [see above, p. 744] or in yield was obtained by applications of potash-magnesia.

NATTRASS (R. M.). **Annual Report of the Mycologist for the year 1932.**—*Ann. Rept. Dept. of Agric. Cyprus for the year 1932*, pp. 44–49, 1 fig., 1933.

This report contains the following items of phytopathological interest other than those already noticed from other sources [*R.A.M.*, xii, pp. 323, 506]. *Vicia* sp. was attacked by a *Cercospora* leaf spot, probably *C. fabae* [ibid., xii, p. 263] not previously reported in Cyprus. It was occasionally severe on plants growing in the shade. The spores measured 70 to 125 by 4 to 6·3 $\mu$ and had up to 12 septa; the dark conidiophores measured 29·4 to 46·2 by 4·2 to 8·4 $\mu$. Cowpeas (*Vigna*) [*sinensis*] were severely attacked by *Uromyces vignae* [ibid., x, p. 810] while French beans [*Phaseolus vulgaris*] in close proximity to, and in some cases touching the affected cowpeas remained healthy. Celery was attacked by *C. apii* [ibid., xi, p. 761] and *Septoria apii* [ibid., xii, p. 546 and last abstract], the latter recorded for the first time in Cyprus. In many of the older citrus groves symptoms apparently identical with those of 'mal secco' were general, but *Deuterophoma tracheiphila* [ibid., xii, p. 214] has not yet been isolated from the affected trees. Citrus fruit rots were caused by an *Alternaria* and by *Pleospora herbarum* [ibid., xi, p. 449].

Mummied pomegranates on the tree showed the presence of a *Ceuthospora* thought by the Imperial Mycological Institute to be probably *C. phyllosticta*, which caused a blackening of the fruits with the formation of black, carbonaceous, multilocular pycnidia under the rind epidermis, on the inner surface of the rind, and on the walls and locules in the fruit. The rod-shaped, slightly curved pycnospores had rounded ends and measured 4 to 5 by 1·5 to 1·8 $\mu$; they were borne on branched conidiophores, usually curved, tapering towards the apex and up to 16 $\mu$ long. The fungus was not seen on living leaves but was isolated from dead twigs and from cankers on living twigs. Cultures from the twigs inoculated into ripe fruits produced a rot identical with that produced by a culture from the fruit: the fungus appears to be an active parasite causing fruit rot, twig die-back, and canker. Another rot was observed on mummied pomegranates, the outer surface of the rind of which was covered with partly immersed fruit bodies up to 1 mm. in diameter. The fungus was identified at the Imperial Mycological Institute as *Coniella granati* (Sacc.) Pet. and Syd. Inoculations with pure cultures on ripe fruits produced a fairly rapid rot. The fungus was seen only in the Paphos district and was not found on twigs or leaves.

A leaf spot of chicory was caused by an unnamed *Alternaria*, identical with one causing a similar disease on the same host in Florida [ibid., ix, p. 224].

An *Oidiopsis* was particularly abundant in late summer and

autumn on eggplant, *Hibiscus esculentus*, *Capsicum annuum*, and tomatoes [ibid., xi, p. 696].

STOREY (H. H.). **Report of the Plant Pathologist.**—*Fifth Ann. Rept. East African Agric. Res. Stat., Amani, 1932–3*, pp. 13–17, 1933.

In addition to items already noticed from other sources, this report contains the following information. Work with *Cicadulina zeae* has shown clearly that the capacity of this insect to transmit the maize streak virus is controlled by an hereditary factor [*R.A.M.*, xii, p. 686].

An attempt to breed strains of tobacco immune from leaf curl [ibid., xii, p. 143] has been initiated with seed of the standard varieties supplied by the Nyasaland and Southern Rhodesian Departments of Agriculture.

The vector of cassava mosaic [ibid., xii, pp. 202, 352], which is known to be a virus disease, still remains to be identified. The 'green flower' [leaf curl] disease of sim-sim [*Sesamum indicum*], important in Uganda and Tanganyika [cf. ibid., xii, p. 552], is also suspected to be due to a virus. Further investigations are necessary in connexion with a streak-like disease of a certain sugar-cane variety, apparently different from the well-known streak of Uba [ibid., xii, p. 658].

HOPKINS (J. C. F.). **A list of plant diseases occurring in Southern Rhodesia. Supplement 3.**—*Rhodesia Agric. Journ.*, xxx, 6, pp. 504–506, 1933.

This further supplement gives a list of the fungal, bacterial, and virus diseases (arranged by their hosts) which were observed on 28 plants in Southern Rhodesia during the period from June, 1932, to May, 1933 [cf. *R.A.M.*, xi, p. 746]. In an amendment to the previous lists the author states that he now accepts the new combination *Alternaria longipes* suggested by Tisdale and Wadkins for the fungus previously identified as *A. tabacina* [ibid., x, p. 763].

**Forty-third Annual Report of the New Mexico Agricultural Experiment Station for the fiscal year ended June 30, 1932.**—85 pp., 9 figs., 1932. [Received September, 1933.]

The following are amongst the items of phytopathological interest in various sections of this report. A reduction in the incidence of chilli pepper [*Capsicum annuum*] wilt [*Fusarium annuum*: *R.A.M.*, ix, p. 630] was effected by keeping the moisture content of the soil to a low level, and by ridging as the plants grew.

The predominant insect vector of virus diseases in tomato fields was *Eutettix tenella*, the adults appearing about 15th June and reaching their maximum abundance at the end of the month. Transmission tests from beets affected with curly top led to the development of tomato yellows in 10 days to three weeks after the infective insects were caged on the plants. The new curly top resistant beet, U.S. No. 1, yielded in infected fields at Las Vegas 13·4 tons per acre, compared with 6·7 for commercial varieties.

The fungus isolated from apple trees affected by measles [ibid., xii, p. 378] has not been positively identified but is stated to belong to the Sphaeropsidales. Infection is confined to the cambium and does not penetrate into the woody portions. A survey of different orchards showed the Jonathan to be the most susceptible variety, while Gano, Ben Davis, Winesap, Arkansas Black, and Delicious are practically immune. The fungus is found mainly on neglected or otherwise diseased trees in badly irrigated or chemically unbalanced soils.

MELCHERS (L. E.). **Plant disease problems in Egypt.**—*Trans. Kansas Acad. Sci.*, xxxv, pp. 38–62, 1932.

The writer's observations on Egyptian phytopathological problems investigated during 1927–9 are prefaced by some general remarks on the topographic and climatic conditions of the country. The following are some of the more interesting records.

Wheat is frequently attacked by a disease first described from India by C. M. Hutchinson (*Mem. Dept. Agric. India*, Bact. Ser., i, 7, 1917), due to the combined activities of a bacterium (*Pseudomonas tritici*) and the eelworm *Tylenchus tritici*, and thought to have been introduced into Egypt on seed. The head may be partially or wholly invaded down to the lower portion of the peduncle. The growth on the ears formed by *P. tritici* is shiny and yellow at first, later becoming hard, darker, and flaky. The actual damage to the wheat seems to result mainly from the eelworm.

In connexion with his studies on wheat mosaic and rosette [*R.A.M.*, x, p 300], the writer found that a high degree of resistance was shown by the Sinai and Persian varieties.

Rust (*Uromyces fabae*) of broad beans (*Vicia faba*) [ibid., xii, p. 596] causes heavy damage every season to this very important crop.

Mosaic occurs on *V. faba* [ibid., x, p. 700 *et passim*] and on *Phaseolus vulgaris*, on which it is common and rather destructive [ibid., xii, p. 614]. Other crops affected with mosaic are tomato (mottled and 'fern-leaf' forms) [ibid., xi, p. 754], pepper [*Capsicum annuum*], sweet melon, and sugar-cane. Streak [ibid., xii, p. 658] was prevalent and widespread on the last-named crop, having probably been confused with mosaic in previous reports.

Bunchy top or rosette occurs to a limited extent and in a relatively mild form in banana plantations.

Gummosis of citrus, peaches, apricots, and plums [ibid., xii, pp. 368, 575] is stated to be very destructive and apparently on the increase. Citrus also suffers considerably from die-back in neglected orchards.

Mango trees are liable to dwarfing, sometimes accompanied by necrosis of the woody tissues, possibly in association with leaf spot (? *Bacillus mangiferae*) [ibid., xi, p. 793].

TRUSCOTT (J. H. L.). **Observations on Lagena radicicola.**—*Mycologia*, xxv, 4, pp. 263–265, 11 figs., 1933.

In the autumn of 1931 the writer isolated *Lagena radicicola* from soil in Vineland, Ontario, on the hosts originally noted by

T. C. Vanterpool and G. A. Ledingham in Saskatchewan, namely, wheat, barley, rye, and maize [*R.A.M.*, ix, p. 581], and in the summer of 1932 it was again found in the same district on *Agropyron repens* and a number of other wild grasses. The Ontario form of the fungus differs from that occurring in Saskatchewan in its typically branched and larger sporangia, as well as in an unusual compound type of spore. Evidence was obtained that more than one resting spore may be produced in a single female thallus. Multiple fertilization was observed in living material of the Saskatchewan form; in that from Ontario the gametangia are so closely entwined that the detection of this process would be very difficult. Hitherto it has been impossible to obtain pure cultures of these fungi, and the question of specific differentiation between the two forms must therefore be left open for the present.

PRETORIUS (W. J.). **Losses caused by rust in Wheat.**—*Farming in South Africa*, viii, 82, pp. 12–13, 1933.

During the seasons 1930–1 and 1931–2 data were collected by the Division of Economics and Markets on the losses caused by wheat rusts [*Puccinia* spp.] in the western Cape Province. According to the estimates of 50 farmers in the Swartland (Malmesbury area), the losses through rust in 1930–1 and 1931–2 were 21·16 and 13·85 per cent., respectively. In the Caledon-Bredasdorp area rust destroyed 16·24 per cent. in 1930–1 but was negligible in the following year. No data are available for the Union of South Africa as a whole, but supposing the above-mentioned losses to represent 10 per cent. of the total, an annual reduction of 300,000 to 400,000 bags, equivalent to the same number of pounds sterling, would be entailed.

NEATBY (K. W.). **The type of infection of Wheat seedlings by Puccinia graminis tritici in the greenhouse as a measure of the percentage infection in the field.**—*Scient. Agric.*, xiii, 10, pp. 625–635, 1933. [French summary on p. 668.]

After a brief reference to his preliminary report of his study of the relation between the reaction in greenhouse seedlings and in the field of the Garnet × Double Cross and Marquillo × H–44–24 wheat hybrids to infection with *Puccinia graminis tritici*, the results of which in regard to the first-named were considered to be inconclusive [*R.A.M.*, xi, p. 438], the author gives details of further experiments carried out on the same lines with the Garnet × Double Cross, Garnet × Marquillo, and Marquillo × Reward crosses and physiologic form 21 of *P. g. tritici*. The results [the statistical significance of which is shown in tables] indicated that in these crosses the inheritance of the field reaction to black rust (as determined by percentage infection) is mainly, if not entirely, controlled by the same factors which govern the inheritance of the seedling reaction in the greenhouse (as determined by the type of the pustules) to form 21. This is considered to show that Marquillo and Double Cross do not possess the 'mature plant' resistance which had been previously shown to exist in H–44–24 and Pentad [ibid., xi, p. 228].

BIRAGHI (A.). **Sul presunto parassitismo dell' 'Urocystis occulta' (Wallr.) Rabenh. sul Frumento in Italia** [On the presumed parasitism of *Urocystis occulta* (Wallr.) Rabenh. on Wheat in Italy.]—*Boll. R. Staz. Pat. Veg.*, N.S., xiii, 1, pp. 174–179, 1933. [English summary.]

After stating that infections of wheat by *Urocystis* are uncommon in Italy, where they have invariably been attributed to *U. occulta* [*R.A.M.*, xii, p. 681] the author briefly summarizes the chief differences between this fungus and *U. tritici.* He points out that neither can infect the host of the other, and that the spores of *U. occulta* germinate readily, have a smooth surface, are arranged in a simple, interrupted layer, and measure 4 to 8 $\mu$ in diameter, while those of *U. tritici* germinate only with difficulty, have a granulated surface, are often confluent and serried, and measure 5 to 12 $\mu$ in diameter. A typical instance of *Urocystis* infection of wheat is briefly described and it is stated that the spores ranged from 7 to 14 $\mu$ in diameter. In view of these facts the author concludes that the fungus examined by him was certainly *U. tritici* and that all the infections of wheat hitherto attributed to *U. occulta* in Italy have in fact been due to *U. tritici.*

HANNA (W. F.) & POPP (E.). **The overwintering of bunt spores in Western Canada.**—*Scient. Agric.*, xiii, 10, pp. 636–637, 1933. [French summary on p. 668.]

This is a brief report of the results of experiments during the winter of 1931–2 in six different localities of Western Canada, which showed that when ears of Mindum wheat infected with bunt (*Tilletia tritici*) [*T. caries*] where left over winter on the surface of the soil, the viability of the bunt spores was found in the spring to range from low in Winnipeg to medium or high in the other places. When, on the other hand, the ears were buried at a depth of 6 inches, the germination in the spring of the spores was very considerably reduced or nil, except at Winnipeg, where it was somewhat higher than that of the spores in the ears left above ground. The results are considered to indicate that the possibility of the soil being infected from bunted ears of the preceding wheat crop left in the field over winter may usually be greatly reduced by autumn ploughing.

EIDELMAN (Mme Z. M.). Основные результаты опытов искусственного уменьшения листовой поверхности в разных географических пунктах. [Fundamental results of experiments involving the artificial reduction of leaf surface in different geographical areas.]—*Bull. Plant Protection*, 3rd Ser.: *Control Measures and Implements*, Leningrad, part 3, pp. 65–72, 1933. [English summary.]

In this paper the author briefly summarizes the results of experiments [which are fully described and discussed in three separate communications] carried out on the same pure line of spring wheat by herself in Leningrad and by E. Telitchko and E. Siriatchenko in Kieff [Ukraine], and on a line of winter wheat and on oats at Belaya Tzerkoff, Ukraine, by V. Shevtchenko, to determine the

effect on the further development of the plants and on their yield of the mechanical recision of varying percentages (from 25 to 100) of the total leaf surface at different stages in the development of the plants, the general aim of the work being to establish the effect of the injury caused by various parasites (e.g. *Puccinia* spp.) to the foliage under different ecological conditions.

The chief conclusions drawn from the Belaya Tzerkoff tests are that the experimental reduction of the leaf area in both winter wheat and oats during the earlier stages (tillering and culm formation) of the plants retards their further development by a maximum of about two weeks and is reflected in the subsequent vigour of the plants, this effect being more pronounced in the reproductive than in the vegetative organs. Recision of the leaves during the tillering and culming phases reduced the yield in grain much more in oats than in winter wheat, and a statistical analysis of the results clearly demonstrated the direct relationship of the percentage reduction in yield to the percentage amount of the leaf surface removed. At later stages the effect of the operation was more uniform on both hosts, but the removal of 100 per cent. of the foliage at the earing stage again affected the oats markedly more than the wheat, the operation resulting in the former in a reduction in yield by 71·8 per cent. of the controls, as against a reduction by 54·9 per cent. in wheat. The quality of the grain (as judged by the relative weight of 1,000 grains) was also more adversely affected by the removal of all the various percentages of leaf at all stages of growth in oats than in wheat. Finally, the experiments demonstrated that the presence on the plants of the lower leaves is of considerable importance to the yield even at the blossoming and milky maturity stages, since the removal of the oldest and lowest leaves at either stage resulted in a reduction of the weight of 1,000 grains by 17 to 20 per cent.

The results of the experiments in Leningrad and Kieff showed that in the latter locality spring wheat displays a much weaker reaction to external stimulation even at stages as early as the two-leaf stage, as indicated by the fact that the coefficient of injuriousness (i.e., ratio of percentage reduction in the dry weight of the plant to 1 per cent. recision of the total leaf surface) of the removal of 50 per cent. of leaf surface was only 0·5 as against 1·26 in Leningrad. It is believed that in Kieff the spring wheat has a greater capacity of compensating for the deficient assimilating surface by intensifying the activity of the leaf portion remaining after the operation, and also that of the leaf sheaths. The effect of the leaf removal was weaker at later stages, as indicated by the injury coefficients of 0·28 and 0·24 (at the culming and flowering stages, respectively) for the removal of 100 per cent. of the leaves in Kieff, as against 0·69 and 0·48 for Leningrad. While the experiments in both localities again showed that the recision of the leaves had a greater depressing effect on the quantity and quality of the grain than on the formation of the vegetative parts, the grain reduction was much less in Kieff than in Leningrad, since in the former a considerable reduction (47 per cent.) in the weight of 1,000 grains was only obtained by the removal of 100 per cent. of the foliage at the two-leaf stage, while marked reductions

were obtained in Leningrad by recisions amounting to 25 and 50 per cent. of the leaf surface (13 and 30 per cent., respectively).

EIDELMAN (Mme Z. M.) & BANKUL (E. A.). Влияние механического уменьшения листовой площади и разных условий питания на накопление сухого вещества у злаков. [Effect of the mechanical reduction of leaf area and of different nutritional conditions upon the accumulation of dry substance in cereals.] —*Bull. Plant Protection*, 3rd Ser.: *Control Measures and Implements*, Leningrad, part 3, pp. 113–130, 2 graphs, 1933. [English summary.]

An account is given of open-air experiments on barley plants grown in pots with sterilized and carefully washed sand, to which various doses of nutrient elements were added, to determine the effect on the subsequent development of the plants of leaf injury of varying degrees of severity, as represented by the mechanical removal of a given percentage of the total leaf area [see preceding abstract]. It was found that at the culming stage the removal of 25, 50, or 100 per cent. of the leaves did not appreciably influence the onset of the development of the inflorescence, flowering, and earing, which depended to a much greater extent on the composition of the nutrient medium. The relative weights of the different vegetative organs also remained fairly constant with different doses of a complete fertilizer, no matter how extensive the lesion was, though of course the absolute weight varied with the severity of the lesion. This leads to the conclusion that soil fertilizers act on leaf-diseased plants in the same way as on healthy ones. Barley reacted to the severity of leaf lesions under the different nutritional conditions to a much less extent than spring wheat, and its yield was also less adversely affected; its root system suffered from the treatment even less than the overground parts. Phosphorus, as well as most of the other nutrients, appeared to have a stimulating effect on the photosynthetic energy, while with nitrogen the tendency was the reverse. Under all the nutritional conditions tested a reduction of up to one-half of the assimilating surface of the plants had a stimulating effect on the photosynthetic activity of the remaining portions of the leaves.

The work is considered to indicate that an analysis of the effect of the single factors concerned in the expression of pathological symptoms in plants (in the present case, the nature and varying doses of nutrients) may lead to an approximate understanding of the operation and influence of these factors on the yield of the plants in nature.

POWERS (L.) & HINES (L.). **Inheritance of reaction to stem rust and barbing of awns in Barley crosses.**—*Journ. Agric. Res.*, xlvi, 12, pp. 1121–1129, 2 figs., 1933.

A brief account is given of the authors' experimental and statistical study (in naturally induced epidemics) of the inheritance of resistance to physiological forms 17, 38, and 49 of *Puccinia graminis tritici* [cf. *R.A.M.*, xii, p. 556], in crosses between a rust-resistant and rough-awned (Peatland) and two susceptible and

smooth-awned (Glabron and Minnesota 462) varieties of barley. The results showed that in these crosses resistance was dominant, and that in Peatland and Glabron the reaction to the rust was differentiated by a single factor pair (*Tt*). No evidence was obtained of a linkage between the factor pair governing the reaction to rust and that determining the roughness or smoothness of the awns in the progeny.

The results are considered to indicate that it should be relatively easy to produce a smooth-awned, high-yielding variety of barley resistant to physiological forms 17, 38, and 49 of *P. g. tritici*.

BENNETT (F. T.). **Fusarium species on British cereals. Fusarium nivale (Fr.) Ces. (= ? Calonectria graminicola (Berk. & Br.) Wr.).**—*Ann. of Appl. Biol.*, xx, 2, pp. 272–290, 4 pl., 1 fig., 2 graphs, 1933.

In a further contribution [*R.A.M.*, xi, p. 504] the author gives details of his study of a strain of *Fusarium nivale* isolated (with *F. culmorum*, *F. avenaceum*, and *F. graminearum* [*Gibberella saubinetii*]) from the base of diseased plants of perennial rye-grass (*Lolium perenne*) and oats on a Cumberland farm, and also from barley grains and the grasses of golf greens in Northumberland and Durham. All his isolations resembled each other in pure culture in morphological and physiological features, but differed constantly and significantly in the size of conidia and in form and rate of growth on certain selective media from a continental strain of *F. nivale* (*Calonectria graminicola*) obtained from Baarn.

Under controlled conditions the fungus was shown to cause in wheat, barley, oats, and rye some loss of plants before or after germination, and also to retard the growth of established plants developing under adverse environmental conditions, independently of whether the infection resulted from contaminated soil or seed. Favourable growing conditions appeared in a large measure to counteract the effects of early attack. It was further shown to attack the ears and grain of these cereals, either preventing the grain from forming or causing discoloration of the formed grains to an extent capable of seriously affecting the yield and the market value of the crops; such attacks, however, appear to occur but rarely in the field, where the chief damage done by *F. nivale* is restricted to a general reduction in vigour of the plants. The effect of infection on perennial and Italian (*L. italicum*) rye-grass is first a reduced rate of growth, and in pot experiments the former was largely killed off by the end of the current season; there was evidence that in the field the death of the plants would occur in the second season of growth. Another distinguishing feature between the continental and the British strains is that, in comparative experiments, the former appeared to be more virulent to the cereals and less virulent to the grasses than the latter.

In pure culture *F. nivale* was found to grow vigorously within the range of normal summer shade temperatures, with an optimum at 20° to 21° C.; it grows slowly at 0° to 1°, and in its vegetative form is able to withstand exposure to temperatures as low as –20°, but is killed in a few days at a temperature of –32° C. While its life and pathogenicity are not appreciably affected by the acid or

alkaline reaction of soils within the ordinary field range, and it was shown to be capable of growing on media with $P_H$ values ranging from 2·5 to 13, with an optimum from 6·5 to 6·9, its conidia did not germinate in media with an acidity of more than $P_H$ 5·2 to 5·0.

WINKELMANN (A.). **Eine Methode zur Prüfung von Mitteln gegen Fusarium im Laboratorium.** [A method of testing anti-*Fusarium* preparations in the laboratory.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, xiii, 7, pp. 49–50, 1933.

A number of [unnamed] preparations were tested in the laboratory for their efficacy against *Fusarium* infection of cereal seed-grain. Naturally infected seeds, treated in the prescribed manner with the different fungicides, were placed in Petri dishes on a medium of 30 gm. oatmeal, 20 gm. agar, and 5 c.c. glycerine per 1 l. of water, with the addition of 0·5 c.c. lactic acid and 50 mg. methyl or gentian violet [*R.A.M.*, xii, pp. 371], the two last-named exerting an inhibitory action on the growth of surface contaminants. The largest number of healthy seedlings was yielded by the lot treated with a liquid solution designated I, and applied by sprinkling at a strength of 0·35 per cent., the seed-grain being subsequently left covered for six hours. Dusts I and II (2 and 3 gm. per kg. of seed-grain) respectively, also gave good results—even better than those with the liquid in supplementary greenhouse-tests, in which the percentages of diseased plants for the three selected preparations were 4·2, 1·1, and 1·8, respectively. The untreated controls were completely infected in the laboratory tests and showed 46·1 per cent. *Fusarium* infection in those in the greenhouse.

PAXTON (G. E.). **Consistent mutation of Helminthosporium sativum on a no-nitrogen medium.**—*Phytopath.*, xxiii, 7, pp. 617–619, 1 fig., 1933.

On Czapek's agar *Helminthosporium sativum*, isolated from barley in California, produced only occasional sectors, whereas all colonies on the same medium without nitrogen gave rise to saltants, of which one type occurred on every culture and differed distinctly from the original colony [cf. *R.A.M.*, ii, p. 59; viii, p. 496; xi, p. 393]. The mycelium of this mutant was darker, growth was faster, and sporulation was heavier than in the normal type, while the spores of the former were darker brown, shorter, and more rounded at the ends, measuring 55 by 22 $\mu$ (average of 500) compared with 72 by 22 $\mu$. No tendency to reversion has been shown by subplants of the saltant during five generations in culture on Czapek's agar. No sectors developed when sucrose as well as nitrogen was omitted from the medium.

SAMPSON (KATHLEEN). **The biology of Oat smuts. III. The development of two biological species of Ustilago kolleri (Wille) on a selection of Avena strigosa orcadensis (Marquand).**—*Ann. of Appl. Biol.*, xx, 2, pp. 258–271, 1 pl., 5 figs., 1933.

In continuation of her studies of the biology of oat smuts

[*R.A.M.*, viii, p. 498] the author describes her histological investigation of the development in *Avena strigosa orcadensis* of two strains of *Ustilago kolleri*, the first of which was shown in preliminary experiments [loc. cit.] to be highly virulent on this host (100 per cent. infection), which was highly resistant to the second, although the latter caused 100 per cent. infection on the potato oats (*A. sativa*). It was found that, under certain experimental conditions, both strains enter the host plant with equal facility, but that while the progressive development of the first strain in the host tissue, culminating in the production of spores in the panicle, agrees closely with the description of the process by other workers (e.g., Kolk) [ibid., x, p. 722], the growth of the second strain, following successful infection of a resistant host such as *A. s. orcadensis*, is retarded and the fungus fails to reach the growing apex before the tissues of the primary node become lignified, with the result that the panicles are not infected. In the case of the virulent strain, however, the author did not find the mycelium of the fungus in the space between the first leaf and the coleoptile, as described by Dr. Kolk, and believes that the parasite usually passes from the coleoptile to younger organs *via* the primary node. Individual strands of mycelium of either strain appeared to be equally healthy within the tissues invaded by them, with no particular microscopical features to distinguish the one from the other. No indications were found of encasing sheaths such as described by various observers.

In a brief discussion of the bearing of these results on the question of the inheritance in oats of resistance to smut, the author draws a parallel between the failure by the non-virulent strain (to *A. s. orcadensis*) to infect throughout its host, and the phenomenon of sterility in higher plants, best explained by incompatibility between pollen and stigma. It is suggested that the host plant may offer an 'uncongenial' medium to the parasite, depending on somewhat similar genes to those responsible for pollen and stigma incompatibility.

BRITON-JONES (H. R.). **Stripe disease of Corn (Zea mays, L.) in Trinidad.**—*Trop. Agriculture*, x, 5, pp. 119–122, 4 pl. [2 facing p. 144], 1933.

Since 1929, maize in Trinidad has been severely affected by a leaf stripe closely resembling that described by Stahl in Cuba [*R.A.M.*, vii, p. 159] and associated with infestation by the leafhopper *Peregrinus maidis*, the vector of Stahl's disease and also of the similar one found in Tanganyika [ibid., xii, p. 143]. Soon after the silks appear, stripes of light-coloured tissue varying in width from thin hair lines to broad bands affecting practically the whole surface of the leaf except the midrib develop along the lamina between the main veins. The affected leaves generally wither from the tip backwards and from the margin inwards. Early attacks also occur and lead to stunting of the plants and bunching of the upper internodes, which are frequently bent over to one side. When the attack is severe the cobs are often worthless, and occasionally they are deformed from outgrowths of the rudimentary leaves composing the husk. The only difference between this disease and

the Cuban one is that the leaf stripes are sometimes reddened in the former.

In a letter to the author, C. N. Priode states that three distinct types of striping, all equally injurious, are present in Cuba, even on plants of the same variety growing in one place. The first type consists in very fine, close stripes due to a whitening of the veins sometimes fading into short strips or dots of various lengths. In severe attacks the affected tissues become necrotic. The second type consists in distinct, coarse, parallel stripes due to whitening of the large veins only, and usually extending the whole length of the leaf. The third type shows broad chlorotic bands affecting the veins and the tissues between, and either extending the full length of the leaf or, more usually, fading into dots or stipple stripes of various lengths. Sometimes the entire leaf bases are affected from side to side, or one or more broad bands may follow the sides of the midrib.

All attempts to reproduce the Trinidad disease by artificial inoculation from the diseased leaves failed, and several attempts to transmit it by means of *P. maidis* gave irregular results, the only successes being obtained in cage experiments in which the plants were grown in poor soil in pots. In one such test two plants and in another, one, became striped in 12 and 21 days, respectively, from the introduction of the insects from diseased plants.

A disease closely resembling maize stripe and also associated with infestation by *P. maidis* was also observed on sorghum.

SKOVHOLT (O.) & BAILEY (C. H.). **Some new facts about molds and bread.**—*Minnesota Agric. Exper. Stat. Bull.* 296, 12 pp., 3 figs. (1 on cover), 1933.

An investigation was carried out to ascertain the factors that favour the development of moulds on stored bread, a problem the significance of which has considerably increased since the introduction of paper wrappers impervious to moisture for loaves. Preliminary experiments, in which the moulds most commonly occurring on bread, namely, *Penicillium expansum*, *Aspergillus niger*, and *Rhizopus nigricans*, were used, showed that at a relative humidity below about 90 per cent. none of them made any growth of practical importance in seven days, while at humidities between 91·2 and 93·9 per cent. *A. niger* and *R. nigricans* produced a heavy growth, the development of *P. expansum* being somewhat less. It was also shown that the addition of 6 per cent. skim milk solids to the dough slightly reduced the rate and extent of mould growth on the stored loaves. While the figures do not suggest that dry skim milk is an effective inhibitor of mould development, the fact that it was shown to increase the moisture retentive capacity of bread prepared with it indicates that its use retards the formation of a moisture film between the crust and the wrapper, and thus affords some protection against the development of moulds inside the latter.

Further experiments established quite definitely that the common mould spores do not survive the usual bread baking treatment, and that the rate of mould growth was directly proportionate to the length of exposure of the loaves to dusty air during the cooling

process, and to the amount of inoculum carried in the air. It was also found that less mould developed on loaves cooled to 120° F. before wrapping than on those cooled to 92°, but both showed less mould growth than loaves wrapped at 135°. The latter led to conditions favourable to mould growth, but the less favourable conditions at the lowest as compared with the intermediate temperature were counterbalanced by the longer exposure to dust during cooling to 92°.

RUGGIERI (G.). **Marciume dei rametti di Arancio amaro prodotto da 'Sclerotinia' sp.** [Twig blight of sour Orange caused by *Sclerotinia* sp.]—*Boll. R. Staz. Pat. Veg.*, N.S., xiii, 1, pp. 140–142, 1 fig., 1933. [English summary.]

The author states that *Sclerotinia* twig blight of citrus is relatively uncommon in Sicily, where it is unlikely to become of any appreciable importance except in localities where owing to the rather cold winters the trees have to be covered and the nurseries planted in sheltered positions on soil rich in organic material. A brief description is given of the usual symptoms, followed by a fuller account of a case, observed on sour orange [*Citrus aurantium* var. *bigaradia*] and probably due to *S. sclerotiorum* [*R.A.M.*, x, pp. 118, 307], in which spheroidal, white or blackish sclerotia had encircled the base of the leaf stalks, causing the leaf and petiole to bend downwards. Where the leaf had already fallen, the sclerotia had formed on the leaf scar, and in some cases they also developed on the internodes, where they were elongated and almost fusiform in shape.

Control should be possible by the prompt removal and burning of the affected twigs.

RUGGIERI (G.). **Osservazioni sopra l'alterazione dei Mandarini prodotta dalla 'Cytosporina citriperda' Camp.** [Observations on the disease of Mandarins caused by *Cytosporina citriperda* Camp.]—*Boll. R. Staz. Pat. Veg.*, N.S., xiii, 1, pp. 143–150, 2 figs., 1933. [English summary.]

During the winter of 1932–3, mandarins [*Citrus nobilis* var. *deliciosa*] in the provinces of Catania and Syracuse, Sicily, and especially those growing in the vicinity of Mount Etna, were widely attacked by *Cytosporina citriperda* [*R.A.M.*, ii, p. 310]. This season was mild, humid, and cloudy, and owing to an exceptionally heavy crop, ripening was delayed by at least three weeks, to between the end of December and 10th January, at a period when the prevailing temperature and moisture conditions strongly favoured fungal attack. In the author's opinion, the fruit became susceptible to infection owing to these favourable meteorological conditions which led to a copious formation of pycnidia on the fruit and to physiological weakening of the trees as a result of the heavy yield.

A very similar disease of mandarins, 'melanosis', was reported by Trabut from North Africa in 1898 and attributed by him to *Septoria glaucescens*. The Italian organism is not a *Septoria*, but superficially it resembles one, the chief difference being the presence of the stroma which it forms under the epicarp and from which the pycnidia arise. That a stroma was also present in Trabut's

fungus is indicated by his description of it as presenting a densely woven mycelium under the epicarp and having confluent pycnidia. The spore measurements of *S. glaucescens* are 12 to 16 by 2·5 $\mu$ and those of *C. citriperda* (though ranging from 12 to 26 by 1·7 to 2·4 $\mu$) are generally 10·5 to 16 by 2 to 2·75 $\mu$; the spore length of *C. citriperda* varies greatly with the medium, reaching 30 $\mu$ on carrot agar.

The author concludes that the two organisms are very probably identical, in which case the correct name should be *C. glaucescens*.

Van Der Plank (J. E.). **Sooty blotch on Citrus.**—*Farming in South Africa*, viii, 86, pp. 195, 197, 2 figs., 1933.

Satisfactory results in the control of sooty blotch of oranges (*Gloeodes pomigena*) have been obtained in recent tests by immersion of the fruit for 30 to 60 seconds in a 5 to 6 per cent. solution of bleaching powder containing 33 to 37 per cent. available chlorine, followed by exposure to the air for 10 minutes to one hour [*R.A.M.*, xi, p. 105]. The cost of the bleaching, inclusive of labour, worked out at about one penny per case for Navel oranges in commercial practice in the Northern Transvaal.

Benton (R. J.). **Prevent mould decay in Oranges. Departmental experiments show how this can be done.**—*Agric. Gaz. New South Wales*, xliv, 6, pp. 451–454, 2 figs., 1933.

This note is prefaced by a table summarizing the results of experiments [a preliminary report on which has already been noticed: *R.A.M.*, x, p. 728] from 1926 to 1930, inclusive, at Gosford, and from 1928 to 1930 at Griffith, on the use of borax or sodium bicarbonate solutions for the control of mould decay of cold stored oranges (among which that caused by *Penicillium digitatum* is stated to be the chief in New South Wales). In 1930, when most rotting occurred, the percentage at Gosford of decayed fruits was reduced from 33·5 in the controls to 1·4 in the borax treated and to 7·1 in the sodium bicarbonate-treated oranges, the figures at Griffith being 12·9, 2·3, and 7·7, respectively. Particularly severe tests in 1932, in which oranges were artificially inoculated with *P. digitatum* through wounds and then kept wrapped at normal temperatures for at least two weeks, confirmed the efficacy of the borax treatment even when reduced to a strength of 5 per cent., with or without the subsequent application of paraffin. Sodium bicarbonate, as well as four proprietary mould preventives (including 'W 3', a substance used in several Californian packing houses), gave varying results, but proved to be less reliable on the whole than borax. The experiments also indicated that rinsing the fruit in water after treatment tends to reduce the efficacy of the treatment.

Ruggieri (G.). **Gummosi e intumescenze delle foglie di Arancio.** [Gummosis and swelling of Orange leaves.]—*Boll. R. Staz. Pat. Veg.*, N.S., xiii, 1, pp. 150–154, 2 figs., 1933. [English summary.]

In the winter of 1932, orange leaves in Sicily developed a form of gum spot, the upper surfaces showing chestnut-coloured, erumpent,

mammillate, lobed pustules surrounded by a yellow halo, and the lower ones light brown or yellowish patches associated with a reduced chlorophyll content of the mesophyll. Hyperplasia of the palisade tissue occurred, with discoloration of the epidermal and palisade cells due to an accumulation of gum in them. As the hyperplasia had developed while the leaf was still growing the epidermis had followed the growth of the underlying tissue without rupturing. The discoloration of the under surface of the leaf was due to necrosis and gummosis of the stomatal cells, though not all the stomata were affected. The cause of the condition is at present obscure, but it had evidently acted for only a short period. It is pointed out that the type of corky spot of citrus leaves figured by Penzig ('Studi botanici sugli Agrumi', Pl. ii, 1887) differs sharply from that referred to in the present paper and cannot be regarded as a true gum spot.

VAN ROECHOUDT (L. L.). **Inspection phytosanitaire dans le nord du Kivu.** [Phytosanitary inspection in the north of Kivu.]—*Rev. Agrol. et Bot. du Kivu*, *1933*, 3, pp. 28–30, 1933.

The writer gives notes on the diseases encountered during his inspection of some forty coffee plantations in north Kivu [Belgian Congo], which included *Colletotrichum coffeanum* [*Glomerella cingulata*] and *Armillaria mellea* [*R.A.M.*, xi, pp. 159, 699].

REYDON (G. A.). **Een bladziekte bij de Koffie.** [A leaf disease of Coffee.]—*De Bergcultures*, vii, 27, pp. 758–762, 2 figs., 1933.

Grafted Robusta coffee plants of a clone of the 'Uganda' variety growing at both low and high altitudes in Java developed a leaf disease during the recent rainy season which proved to be due to a species of *Rhizoctonia*, probably *R.* [*Corticium*] *solani*, and which also attacked native Java coffee [*Coffea arabica*] bushes at altitudes of over 1,000 m. The disease was first seen in the Kaliwining experimental plantation, where a whole row of seven-year-old Uganda grafts was attacked, while the rest of the garden, including other clones of the same origin, was free from infection.

In the early stages the leaves show greyish-green to black, sharply defined, round to irregular spots between the lateral veins on both surfaces, the tissue round the line of demarcation being slightly sunken. In very damp conditions, as when leaves bearing lesions are placed in a moist chamber, a cobweb-like mycelium covers the spots and forms round pseudosclerotia, 1 to 1·5 mm. in diameter, in about a week. The centres of the lesions turn pale as they dry out and become torn. Affected young leaves are often malformed and look scorched. Some of the older Java trees were defoliated, and a top die-back developed on young plants of this variety in the same plantation, which was the only locality where serious injury was observed.

Cross-inoculation experiments with the *arabica* and *robusta* strains of the fungus gave positive results on both species. *Colletotrichum coffeanum* [*Glomerella cingulata*: see preceding abstract] developed on a number of the shrivelled spots caused by *C. solani* but gave entirely negative results in inoculation tests, all of which with *C. solani* were positive. Further investigations are necessary

to decide whether the leaf form of *C. solani* is identical with that commonly found as an agent of damping-off among coffee seedlings from six to ten months old.

Although the leaf disease is most prevalent during the rainy season, it may occur in the dry weather, the development of the fungus being very rapid during cool and dewy nights. Given the necessary degree of coolness and moisture, the leaf disease may even be found among bushes standing in the full sunlight. In general, the disease may probably be held in check by suitable cultural methods, but where severe infection is threatened a preventive application of Bordeaux mixture with an adhesive, e.g., resin-soda, may be advisable.

KADEN (O.). **Das Kaffeesterben in Angola, eine physiologische Welkekrankheit.** [The dying-off of Coffee in Angola, a physiological wilt disease.]—*Der Tropenpflanzer*, xxxvi, 4, pp. 139–146, 1933.

An account is given of a physiological wilt disease chiefly affecting a Robusta type of coffee, *Coffea canephora* var. *laurentii*, in Angola, Portuguese West Africa. The trees wilt and in severe cases die within a few days at the onset of the dry season (April to May), while in milder attacks they may partially recover though without regaining their original vigour. The symptoms are more acute in Amboim than in Cazengo, while in Dembos they have only been observed on a few trees of *C. arabica* at an altitude of 700 m. above sea level. Soil analyses [the results of which are tabulated] showed that the humus content of the soil around the affected trees was only 7·31 per cent. at a depth of 1 m. compared with 11·31 per cent. in healthy sites; corresponding reductions in pore volume and water-holding capacity were also registered. The writer has found the same disease in Costa Rica [*R.A.M.*, xii, p. 168], and there seems to be no doubt that the Angola trouble is also identical with the 'yellowing' of coffee in Kenya [ibid., x, p. 519]. In order to maintain a high humus content in the soil, suitable shade trees [a list of which, available in Angola, is given] should be planted. Gentle slopes should be chosen for the plantations, with adequate protection from wind, attention being also paid to green manuring, cover crops, and the control of weeds.

DRECHSLER (C.). **Morphological features of some fungi capturing and killing amoebae.**—*Journ. Washington Acad. Sci.*, xxiii, 4. pp. 200–202, 5 figs., 1933.

A large protozoan, provisionally identified as *Amoeba verrucosa*, was attacked in agar plate cultures from plantings of diseased rootlets and the like by a fungus characterized by rather short, somewhat tapering, sparsely branched, noticeably differentiated conidiophores bearing elongated bicellular conidia with an empty third cell in the form of an apical appendage nearly equal in length to the two living cells together. Capture was effected by the attachment of the amoeba to short, somewhat globose, yellowish, adhesive protuberances borne laterally on prostrate superficial hyphae. On perforation of the pellicle the hyphae formed an internal complex of swollen, ultimately septate elements by

dichotomous branching. A smaller amoeba was captured through adhesion to the prostrate, narrow, non-septate, hyphae of another fungus which bore on short, undifferentiated aerial branches unicellular, inversely flask-shaped spores with a short, empty basal stipe and 2 to 6 (usually 3 to 5) divergent, tapering, empty subapical appendages approximately equal in length to the single living cell. Three other fungi were observed to capture amoebae by similar methods, and were characterized by caducous, fusiform or acicular, continuous, hyaline conidia, and by yellow oospores, with sculptured, ridged external thickenings of the oospore wall. In all three species the oospore is produced through the fertilization of a terminal globose oogonium by a slightly expanded terminal antheridium borne on a branch arising from an adjacent hypha. In some cases the germ-tube from a conidium gives rise directly to a sexual organ, while in other instances it directly penetrates the host.

DRECHSLER (C.). **Morphological features of some more fungi that capture and kill nematodes.**—*Journ. Washington Acad. Sci.*, xxiii, 5, pp. 267–270, 4 figs., 1933.

Further details are given of the morphology of four more fungi with morphological similarities to those previously reported, found capturing and killing nematodes such as *Diploscapter coronatus*, *Cephalobus persignis*, and species of *Rhabditis*, *Diplogaster*, and *Bunonema* in agar cultures [*R.A.M.*, xii, p. 512 and next abstracts]. One of the four organisms differs from the others in having at first a non-septate mycelium which captures the worms by a pad of sticky material and produces globose conidia, mostly intercalary in the creeping hyphae and generally characteristic of the genus *Pythium*.

DRECHSLER (C.). **Several more fungi that prey on nematodes.**—*Journ. Washington Acad. Sci.*, xxiii, 7, pp. 355–357, 3 figs., 1933.

Further observations are made on the morphology of the fungi destroying nematodes (*Rhabditis* and *Cephalobus* spp.) in agar cultures [see preceding and next abstracts], and of the mode in which the prey is captured, i.e., by intramatrical, non-constricting hyphal loops or by anastomosing, adhesive, superficial constricting loops; in the latter case the nematode is virtually suffocated before the initiation of mycelial invasion. Since organs of capture are generally absent in pure cultures of the predacious Hyphomycetes hitherto isolated, it would appear that a tactile stimulus supplied in nature by living nematodes may be of importance in their development.

SHERBAKOFF (C. D.). **A new fungus parasitic on nematodes.**—*Mycologia*, xxv, 4, pp. 258–262, 1 pl., 1933.

*Anulosporium nematogenum* n. g., n. sp., recently found attacking nematodes of the genera *Aphelenchus*, *Cephalobus*, *Dorylaimus*, and *Rhabditis*, as well as the larvae of some minute flies [cf. preceding abstracts], is characterized by hyaline, septate hyphae, 1·7 to 2·2 $\mu$ in diameter outside the host, and 2·5 to 3·5 $\mu$ within it;

simple, sometimes septate conidiophores, 20 to 30 $\mu$ in length; and hyaline, usually triseptate conidia, 2·5 to 3·5 $\mu$ in diameter, forming closed rings 13 to 23, mostly about 18 $\mu$ in diameter, in which the insects are firmly caught.

POST (THELMA B.). **A new disease of Dahlias.**—*Journ. Washington Acad. Sci.*, xxiii, 4, pp. 203–208, 9 figs., 1933.

Diseased dahlia stems received from South Carolina in July, 1932, bore both the pycnidial and sclerotial stages of *Macrophomina phaseoli* (*Rhizoctonia bataticola*) [*R.A.M.*, xii, p. 201]. Sclerotia developed in three days in cultures of the mycelium present in the petioles, stems, and roots. Pycnidia appeared in one acid maize meal culture from sclerotium-containing tissue in 18 days, a formation of sclerotia preceding the appearance of the pycnidia. Spores from these pycnidia germinated readily, whereas the spores from pycnidia found on the host failed to germinate when transferred to various nutrient media, even though young pycnidia and spores were used [cf. ibid., vii, p. 62].

Spores from the pycnidia obtained in culture yielded further pycnidial cultures when sown on steamed dahlia stems or on pieces of epidermis from these stems placed on nutrient agar plates. Sclerotia also developed in these cultures. No pycnidia were formed in similar cultures on sweet clover [*Melilotus alba*], sunflower, and string bean [*Phaseolus vulgaris*] stems. It is not yet known whether the pycnidial stage of *M. phaseoli* in the present experiments arose as a saltant from the sclerotial fungus or from mycelium that may have been mixed with the sclerotia in the diseased tissue. In view of the rarity of the pycnidia in culture (this is stated to be only the third record) [cf. ibid., ix, p. 686] the former theory seems the more tenable. The strain producing both sclerotia and pycnidia has been repeatedly transferred in single-spored culture and has continued to form both pycnidia and sclerotia.

The pycnidia found in the epidermis of the dahlia stem measured 171 to 198 $\mu$ in diameter and the spores 18 to 25 by 7·2 to 9 $\mu$; on potato dextrose agar the corresponding dimensions are 136 to 200 and 18·2 to 28 by 7·2 to 10·8 $\mu$, respectively. The young pycnidium is thin-walled and composed of angular cells [ibid., vi, p. 757] and it becomes black and carbonaceous with age. The sclerotia found in the pith in nature ranged from 62 to 117 $\mu$ in diameter, the corresponding dimensions on potato dextrose agar being 40 to 80 $\mu$. The dahlia fungus thus belongs in strain C of *R. bataticola* according to Haigh's classification [ibid., ix, p. 686; see also xii, p. 727]. The pycnidia varied greatly in shape and size in culture and showed a tendency to form several ostioles (up to four) except on steamed dahlia stems, on which only one ostiole developed, as in nature.

Discussing the taxonomy of the fungus, the writer points out that in 1904 D'Almeida and Da Camara described a fungus on *Dahlia variabilis* at Coimbra, Portugal, which they named *Macrophoma henriquesiana* (*Rev. Agron.*, ii, p. 218, 1905). The diameter of the pycnidia of this organism is given as 140 to 190 $\mu$ and the spore dimensions as 17 to 23 by 5 to 8 $\mu$, and in these and other

particulars it approximates to *Macrophomina phaseoli* and is in all probability identical.

GREEN (D. E.). **A disease of Antirrhinums new to Great Britain.** —*Gard. Chron.*, xciv, 2433, p. 131, 1 fig., 1933.

A popular note is given on the symptoms of rust (*Puccinia antirrhini*) [*R.A.M.*, x, pp. 534, 742] of *Antirrhinum* [*majus*] in connexion with the first report of its occurrence in Great Britain. Specimens were sent from Kent on 2nd July to the Laboratory of the Royal Horticultural Society and the identification of the rust was confirmed by Dr. G. H. Pethybridge, of the Plant Pathology Laboratory of the Ministry of Agriculture. The rust has been known for many years in the United States and Bermuda, where it causes considerable losses.

DU PLESSIS (S. J.). **Drie nuwe siektes van blomtuinplante.** [Three new diseases of ornamentals.]—*Ann. Univ. Stellenbosch.*, xi, Ser. A, 2, pp. 1–16, 5 figs., 1933. [English summary.]

*Gaillardia* sp. at Stellenbosch, South Africa, has recently (1932–3) been observed to show a concentric, brown to grey spotting of the leaves, sometimes also affecting the stems and pedicels, caused by *Phoma gaillardiae* n. sp. The fungus is characterized by dark pycnidia, 113·6 to 165·4 by 99·4 to 156·2 $\mu$ in diameter, with smooth, hyaline, biguttulate, cylindrical to subelliptical or subfusoid conidia, 4·8 to 8·9 by 1·4 to 2·2 $\mu$, borne on simple, filiform conidiophores, 4·5 to 8·2 by 1·3 to 1·7 $\mu$.

*Chrysanthemum* sp. in the Paarl district suffers from a leaf disease characterized by circular brown spots with a dark brown margin, sometimes encircled by a pale yellow halo. The causal organism, *Epicoccum chrysanthemi* n. sp., forms hypophyllous or amphigenous, erumpent, dark sporodochia, 56·8 to 156·2 $\mu$ in diameter, and dark, globose, densely echinulate, subrectiform, unicellular conidia, 13 to 25·2 $\mu$, borne on dark, simple, broadly clavate conidiophores, 8·2 to 16·7 by 5·1 to 8·5 $\mu$.

The so-called 'black foot' disease of *Stapelia*, *Trichocaulon*, *Caralluma*, *Davalia*, *Hoodia*, *Huernia*, *Sarcophagophilus*, and *Tavaresia* spp. in the Karoo and other districts may be recognized by a black striped discoloration of the stem bases at or near soil level, which ultimately extends right round the crown and kills the plants. The causal organism, *Triposporium stapeliae* n. sp., is characterized by numerous conidia, at first irregularly, clavate to subclavate, with narrow bases and broad, round apices, forking at maturity into two apices (Y form), the quinqueseptate base measuring 23·3 to 34 $\mu$ in length and the two bi-, rarely triseptate arms 8·5 to 14·7 $\mu$, the total size of the conidium being 23·5 to 45·6 by 13·6 to 17 $\mu$. These organs are borne on long, brown, simple conidiophores, sometimes forked at the mostly subpedicellate apex and then often nodular at the angles, 51 to 147·3 by 4·8 to 6·9 $\mu$. The fungi are furnished with Latin diagnoses. The conditions favouring infection by them are discussed and some directions given for their control.

FR. **Die Weisstüpfligkeit der Luzerne.** [The white stippling of Lucerne.]—*Deutsche Landw. Presse*, lx, 29, p. 371, 1933.

Of recent years lucerne crops in Germany have been affected by a white stippling of the leaves [cf. *R.A.M.*, viii, p. 510]. The spots begin to develop round the upper leaf margin, whence they spread in increasing numbers over most of the surface. The diseased plants are irregularly distributed throughout the stands, with a tendency to predominate near the edge of the field. The roots of affected plants show symptoms of necrosis, sometimes extending to the pith of the roots and stems. The primary cause of the trouble seems to be injury to the roots through frost, the white stippling of the foliage being merely an expression of transpirational disturbances due to necrosis. No trace of insect or fungal injury could be detected in the spots.

WEBER (G. F.). **Stem canker of Crotalaria spectabilis caused by Diaporthe crotalariae, n. sp.**—*Phytopath.*, xxiii, 7, pp. 596–604, 4 figs., 1933.

*Crotalaria spectabilis* at Gainesville and two other localities in central Florida was observed in 1930 to be attacked by a stem canker, characterized by wood-brown (Ridgway) lesions, becoming zonate by the formation of greyish-white mycelial bands beneath the epidermis. Infection generally occurs through leaf or branch scars, and once within the stem the fungus, which is described [with an English diagnosis] as *Diaporthe crotalariae* n. sp., rapidly invades all parts, sometimes killing up to 30 per cent. of the plants in a field.

*D. crotalariae* is characterized by globose to lenticular, black, pseudoparenchymatous perithecia, embedded in stromata between the bark and wood, with walls 220 to 380 $\mu$ in diameter; erumpent beaks, 1 to 2 mm. long, tapering, black, with brownish, rounded tip, hairy on the surface; subsessile, elongate-clavate, aparaphysate asci, average size 34·01 by 6·85 $\mu$; and irregularly biseriate, hyaline, ellipsoid, obtuse, bicellular ascospores, 9·12 to 12·31 by 2·28 to 3 $\mu$, average 10·95 by 2·5 $\mu$. The pycnidial stage of the fungus, the genetic connexion between which and *D. crotalariae* was established by single ascospore cultures, is named *Phomopsis crotalariae* n. f. nom. and is characterized by subepidermal, irregular to subglobose, scattered, black, thick-walled, simple or chambered, pseudoparenchymatous pycnidia, 200 to 450 $\mu$ in diameter; ovate to elongate, hyaline, guttulate, unicellular pycnospores, 5·9 to 10 by 1·9 to 2·8 $\mu$, average 7·73 by 2·28 $\mu$; simple, hyaline, tapering sporophores, 15·4 to 26·6 $\mu$ long; and rare, slender, hyaline, hooked stylospores, 16·6 to 30·94 by 1·8 to 2·3 $\mu$.

The pathogenicity of the fungus was established by successful inoculations of *C. spectabilis* with pycnospore and ascospore suspensions from pure cultures and with fragments of the mycelium applied to fresh leaf scars or through wounded axillary buds. Symptoms were visible on the neighbouring part of the stem after 14 days, and were identical no matter which stage of the fungus was used. Pycnidia appeared in four weeks and perithecia several weeks later, after the diseased parts were cut out and placed in moist chambers.

WESTON (W. H.). **A new Sclerospora from Nyasaland.**—*Phytopath.*, xxiii, 7, pp. 587–595, 2 figs., 1933.

This is an extended account [accompanied by a Latin diagnosis of the fungus] of *Sclerospora butleri* on *Eragrostis aspera* in Nyasaland, a preliminary note on which has already been published [*R.A.M.*, x, p. 389]. So far the organism is known only in the locality of its original detection, but since the host is common throughout tropical Africa, it is thought probable that a more intensive survey will reveal a wider distribution. *E. aspera*, though a troublesome weed in coffee plantations and other cultivated areas, is a valuable fodder and severe attacks by *S. butleri* might therefore assume considerable importance. The taxonomy of the fungus is briefly discussed.

THOMAS (H. E.) & PARKER (K. G.). **Fire blight of Pear and Apple.**—*Cornell Agric. Exper. Stat. Bull.* 557, 24 pp., 1 col. pl., 9 figs. (1 on cover), 1933.

This bulletin represents an attempt to summarize, for the use of fruit growers, the most up-to-date knowledge of fire blight (*Bacillus amylovorus*) of pears and apples [*R.A.M.*, xii, p. 700], with particular reference to its symptomatology. Observations in 1930 and 1931 indicated that *Crataegus monogyna* [*C. oxyacantha*] and *C. punctata* are natural hosts of *B. amylovorus*, while several other species of the genus can be artificially infected. In discussing control measures, the authors give details of their own experience from 1926 to 1931, inclusive, in a western New York orchard of some 3,000 pear trees, with a slight admixture of apple trees, in which they obtained fair to good control by means of a systematic removal each year of all infected organs from the trees, at an average annual cost scarcely greater than that of a single spray application in the same orchard.

LUDWIGS (K.). **Das Fusikladium in seiner Abhängigkeit von Klima, Standort, Obstarten und -sorten.** [*Fusicladium* in its relation to climate, habitat, and kinds and varieties of fruit.] —*Obst- und Gemüsebau*, lxxix, 7, pp. 101–102, 1933.

A brief, general account is given of the occurrence of apple scab (*Fusicladium*) [*Venturia inaequalis*] in relation to climatic, local, and varietal factors, with notes on appropriate spraying schedules, reference being specially made to Loewel's investigations of the disease in the Hamburg district [*R.A.M.*, xii, p. 297].

MOORE (M. H.). **Some incidental effects of routine scab-sprays, with special reference to Apple fruit sawfly control. A side-light on the interpretation of field spraying experiments.**—*Ann. Rept. East Malling Res. Stat. 1st Jan. 1932 to 31st Dec. 1932*, pp. 90–98, 1933.

Applications against apple scab [*Venturia inaequalis*: *R.A.M.*, xii, p. 297] of Bordeaux mixture and lime-sulphur with and without lead arsenate at East Malling gave control of sawfly (*Hoplocampa testudinea*), and, on Cox's Orange Pippin trees, brown rot (*Sclerotinia fructigena*) [ibid., x, p. 250] was also always less on the sprayed trees when lime-sulphur was the fungicide used, though

pink bud applications of Bordeaux mixture caused severe cracking and russeting with the result that *S. fructigena* penetrated the cracks and some of the sprayed trees showed more brown rot than the controls. Post-blossom applications of Bordeaux mixture caused surface russeting but very little cracking, and brown rot infection was slight.

MOORE (M. H.). **Spraying trials against Pear scab (Venturia pirina). Some practical and theoretical aspects of the interpretation of the results.**—*Ann. Rept. East Malling Res. Stat. 1st Jan. 1932 to 31st Dec. 1932*, pp. 99–108, 1 plan, 1933.

The results of the author's spraying experiments at East Malling in 1931 and 1932 for the control of pear scab [*Venturia pirina*: *R.A.M.*, xii, p. 639] are further discussed and a detailed account, supported by tables, is given of the methods by which the efficiency of the various spraying programmes was assessed.

Two distinct methods of grading the fruits with regard to scab infection were employed. In the first or 'counting' method the percentage of scabbed fruits was alone considered and the spraying efficiency was expressed by the percentage reduction of scabbed fruits in the sprayed trees as compared with the controls. Thus, if 50 per cent. of the control fruits but only 10 per cent. of those sprayed were scabbed the efficiency was 80 per cent. In the second or 'category' method the total area of scab infection on the fruits was calculated and the percentage reduction of this on the sprayed trees as compared with the controls gave the measure of efficiency. The fruits were divided into five categories, unscabbed and with four numerical degrees of scabbed areas from light ($0–\frac{1}{4}$) to heavy (1–2), respectively. The number of fruits in each category was multiplied by the category mean (e.g., $\frac{1}{8}$ for light and 1·5 for heavy) to give the total scab area (scab-equivalent) of the sample. This was multiplied by a constant (100) to avoid excessive decimals. In the case cited the scab-equivalent on the controls was 36·5 and on the sprayed trees 1·25, the spray efficiency being thus 97 per cent.

Of these two methods the second is considered to be the more accurate, but the use of both may give valuable indications. Two different fungicides may give the same scabbed area, but in one a number of small spots may be distributed on a great many fruits while in the other there are large spots on fewer fruits. The larger number of quite clean fruits may render the second the more valuable commercially.

Most of the practical results of the tests have been mentioned in the previous notice [loc. cit.], but the following may be added. A considerable reduction in the number of fruits reaching maturity was caused in 1931 by the use of burnt lime Bordeaux mixture as compared with the controls or the hydrated lime Bordeaux, the latter giving the largest number. The loss from the burnt lime Bordeaux was undoubtedly due to blossom injury caused by the pre-blossom application, which inadvertently was deficient in lime. In 1932 neither type of Bordeaux caused damage. The figures obtained in both years are considered to demonstrate the greater

commercial value of Bordeaux than lime-sulphur where scab control alone is concerned.

TANAKA (S.). **Studies on black spot disease of the Japanese Pear (Pirus serotina Rehd.)**—*Mem. Coll. Agric. Kyoto Imper. Univ.* 28 (Phytopath. Ser. 6), 31 pp., 2 pl., 3 figs., 2 graphs, 1933.

A comprehensive account is given of the writer's studies on the black spot disease of Japanese pears (*Pyrus serotina*), which is prevalent throughout Japan and Korea, especially on the superior Nijisseiki variety; other susceptible sorts include Doitsu, Hakata-ao, and Meigetsu, while Inamura-aki, Taihaku, Waseaka, Chōjūrō, and Okusankichi are highly resistant. Several papers on this disease have appeared in Japanese, since it was first reported by Bokura in 1917.

The causal organism, which is named *Alternaria kikuchiana* n. sp. (with English and Latin diagnoses), appears to enter the fruit and the young leaves and shoots through the cuticle, stomata, and lenticels. The first small, black specks develop on the fruit in May or June, later expanding and coalescing into large, irregular, blackish-brown, circular lesions, with conspicuous black, concentric rings. The diseased fruit makes uneven growth, often cracks, and finally drops. The young leaves and petioles are similarly attacked at the same time as the fruit. On the current year's shoots the black specks extend into oblong, slightly sunken streaks with concentric rings, which finally kill the shoots.

*A. kikuchiana* is characterized by olivaceous-brown hyphae, 3 to 6 $\mu$ in width, which rapidly produce a brown pigment (like melanin) on penetration of the host. The fasciculate, simple or branched, olivaceous-brown conidiophores bear oblong, ovate, or muriform, occasionally obclavate or packet-shaped conidia, with 1 to 10 transverse and 1 to 3 longitudinal septa, sometimes echinulate, often short-beaked, occasionally catenulate, and 9·5 to 69·5 by 6 to 22 $\mu$ in diameter (on the host). Four strains of the fungus were encountered: I and IV are distinguishable by producing relatively few conidia on the host as compared with II and III; strain II showed the most vigorous mycelial growth, sporulation, and pigment production. Conidia were produced in abundance by all the strains in culture on pear decoction agar. Saltation was frequently observed in strains II and III, particularly at fairly high temperatures, two types of mutants being distinguished, the mycelial and conidial, as described by R. Bonde for *A. solani* [*R.A.M.*, viii, p. 737].

The optimum temperature for the growth of *A. kikuchiana* appears to be about 28° C. The conidial strains tend to make vigorous growth at higher temperatures than the mycelial. The optimum hydrogen-ion concentration for growth is about $P_H$ 6·0. Infection was shown to occur at a relative atmospheric humidity exceeding 90 per cent. at a temperature range of 24° to 30°. The filtrate of culture solutions of *A. kikuchiana*, passed through Chamberland's filter F, contains a toxic substance which was found to be responsible for the spotting of the fruit. This substance lost its virulence on heating to 100°.

The taxonomy of the fungus is briefly discussed. A comparative study was made of its morphology and host relations and those of *A. bokurai* M. Miura (*Southern Manchuria Railway Co., Ind. Proc.*, xxvii, p. 513, 1928), the agent of a similar disease on Chinese pears in Manchuria. The two fungi were found to differ both in conidial dimensions and pathogenicity, *A. kikuchiana* being unable to attack the Chinese pear, while *A. bokurai* failed to infect the Nijisseiki Japanese variety.

OVERHOLSER (E. L.), OVERLEY (F. L.), & CLAYPOOL (L. L). **Cork or drought spot in Apples and Pears.**—*Better Fruit*, xxxvii, 10, pp. 5–6; xi, p. 11, 2 figs., 1933.

An account is given of the physiological conditions described in apples as 'cork' and 'drought' spots [cf. *R.A.M.*, ix, p. 322]. In 'cork' the brown lesions are beneath the skin or are deeply seated in the flesh, usually in association with the larger vascular bundles, and the affected fruits are usually normal in appearance at first but may become deformed later. In 'drought spot' the dead tissue appears just beneath the skin as irregular spots, brown streaks occasionally following the vascular bundles deeper into the flesh, and the spots at first may exhibit a water-soaked appearance. Similar lesions were observed affecting pears (chiefly of the d'Anjou variety) in central Washington in 1928 and again in 1931, when they resulted in many instances in the rejection of over 50 per cent. of the crop.

In a discussion (based mainly on field observations) of the factors involved in the causation of these troubles, it is stated that they are probably produced by environmental conditions and cultural practices interfering with a normal supply of water to the developing fruits. Amongst these are (1) a light crop, which favours a luxuriant development of foliage causing an exaggerated withdrawal of water from the fruits during periods of excessive transpiration [loc. cit.]; it was observed in 1931 that one portion of an orchard which had been severely defoliated owing to insect injury, produced a much lower percentage of fruit with cork spot than the less defoliated parts of the orchard. (2) High temperatures during the growing season. (3) Periods of low relative humidity. (4) Strong drying winds. (5) Too close planting, which reduces the mass of soil available to each individual tree. (6) Growth on soils with inadequate moisture-holding capacity. (7) Insufficient or excessive irrigation. (8) Root injury caused by low soil temperatures, or by excessively deep disking or subsoiling. There was also some evidence that the use of Japanese pear seedlings (believed to be *Pyrus serotina*) as stocks for pears is a contributing factor to the development of cork spot.

GOIDANICH (G.). **Un deperimento dei Susini.** [A wilt of Plums.] —*Boll. R. Staz. Pat. Veg.*, N.S., xiii, 1, pp. 160–174, 8 figs., 1933. [English summary.]

In this account of a wilt of plum trees (chiefly affecting the Burbank variety) reported from various parts of Italy, the author states that affected trees sometimes come into leaf, and may even blossom, in winter. When vegetation begins, the leaves open

before the flowers, or both may appear simultaneously. The foliage of the affected trees is chlorotic, the crop is small and does not ripen completely, and death ensues in two or three years.

From the trunk to the extremities of the small branches the phloem shows rusty-red areas which may appear all around the limb. The discoloration occasionally reaches the cambium, but generally it does not extend so far, with the result that the meristematic tissues function normally, new wood and phloem being produced and in turn becoming discoloured. The outermost part of the phloem is also usually unaffected. The alternation of darkened and normal zones in the phloem indicates that the cause of the condition continues to act only during certain periods which are not brief and irregular as in the case of frost damage. The old, necrosed phloem is separated from the new, healthy part by a corky layer, but if this does not form completely the necrosis extends to the cambium, and the wood may, exceptionally, become affected.

The cause of the condition is at present obscure, all attempts to isolate a parasitic organism from affected material having given negative results. In some respects the wilt resembles closely the type of apricot apoplexy reported by Chabrolin from the Rhone valley [*R.A.M.*, viii, p. 656; ix, p. 255; xi, p. 791].

BENNETT (C. W.). **Further observations and experiments with mosaic diseases of Raspberries, Blackberries, and Dewberries.**—*Michigan Agric. Exper. Stat. Tech. Bull.* 125, 32 pp., 5 figs., 1 diag., 1932.

A detailed, tabulated account is given of the writer's observations and experiments in Michigan on raspberry, blackberry, and dewberry [*Rubus* spp.] mosaic, of which two forms are distinguished, red and yellow [*R.A.M.*, x, p. 530; xii, p. 204]. The former is characterized by a low temperature maximum for symptom expression and by mottling and necrosis of the leaf petioles and cane tips. It varies in severity from very mild mottling of the first spring leaves to rosetting and severe necrosis of black raspberries [*R. occidentalis*], causing the death of the plants in a few years. Yellow mosaic, on the other hand, is most evident at the height of summer, when distinct yellowing with practically no necrosis develops. The two types are often found in combination and the possibility that they may be due to strains of a single virus is not excluded. In red varieties affected by yellow mosaic, mottling is accentuated by the presence of red mosaic at temperatures too high for the latter alone to produce symptoms. In black varieties cane striping develops as a result of mixed infection by the two types.

The red and yellow mosaics vary in the rate of dispersion, the former moving to all parts of the plant during the first season, while the latter, as a rule, does not progress from the inoculated cane to others of the same hill until the spring following infection. On experimental plants, the red virus moved downwards from the tips of first-year black raspberry canes at a rate of some 0·2 inch per hour. Neither virus moved through a portion of the stem from which a ring of bark had been excised.

The chief agent of mosaic dissemination is considered to be the aphid *Amphorophora rubi*; *A. rubicola* and *A. sensoriata* are of secondary importance, though apparently capable of transmitting, while *Aphis rubiphila* is an uncertain and, in any case, a very rare vector. *Amphorophora rubi* occurs in large numbers on the Latham, King, and St. Regis raspberry varieties, as well as on the wild red raspberry (*R. strigosus*), and spreads rapidly from the two first-named to adjacent black varieties. This aphid acquired the yellow mosaic virus in a feeding period of two hours and transmitted it to healthy plants during the next forty-eight, while the red virus was acquired in twelve hours and transmitted during the next twelve. Aphids subjected to brief periods of feeding on healthy plants lost the red virus and probably also the yellow one, suggesting that transmission is mechanical. The insects act as vectors of both types of mosaic at all stages of their development.

HARRIS (R. V.) & GRUBB (N. H.). **The commercial control of Raspberry-mosaic disease.**—*Ann. Rept. East Malling Res. Stat. 1st Jan. 1932 to 31st Dec. 1932*, pp. 149–151, 1933.

An intensive study of raspberry mosaic [see preceding abstract] at East Malling since 1924 has shown that the direct control of the disease by roguing out the affected stools in established fruiting plantations is uneconomic, and that a practical scheme of control should aim at providing the grower with virus-free supplies of cane. Commercial plantations should no longer be regarded as a source both of fruit and of canes for planting.

In 1927, experimental cane nurseries for the production of virus-free Lloyd George canes were started at East Malling, and in 1930, six daughter-nurseries were planted in various places, each with 300 canes from the original nurseries. These were inspected twice in 1931 and twice in 1932, and about six mosaic-infected stools were removed from each during the two-year period, the labour required being negligible in relation to the output, which in 1932 ranged from 1,800 to 9,500 canes per nursery (average, 5,600). The demand for virus-free canes from growers wishing to lay down such nurseries themselves and from those requiring reliable and uniformly vigorous canes for fruiting plantations greatly exceeded the supply. Full directions are given for the planting and maintenance of such nurseries.

HARRIS (R. V.). **The infection of Raspberry fruits by the cane-spot fungus.**—*Ann. Rept. East Malling Res. Stat. 1st Jan. 1932 to 31st Dec. 1932*, pp. 86–89, 1 pl., 1 fig., 1933.

In 1932, a serious deformation of the fruits of some varieties of raspberries, especially Baumforth Seedling B, was reported from several parts of Great Britain. The affected fruits bore acervuli of the *Gloeosporium* [*venetum*] stage of *Plectodiscella veneta* [*Elsinoe veneta*: *R.A.M.*, xi, p. 724].

The infected drupels were usually grouped together and showed every degree of deformation. Berries slightly attacked just before ripening appeared to be normal, except that two or three of the drupels were small and pale, but where heavy infection had taken

place soon after fertilization much of the mature fruit consisted of minute, dry, withered drupels.

On the new canes of the affected varieties the attack was exceptionally slight and due to infection after late July, but the fruiting canes were heavily spotted on the laterals and pedicels. This incidence indicated that the main wave of ascospore infection instead of taking place as usual between late April and the end of May, during the initial stages of the current year's cane, had occurred while the fruits were maturing. Optimum conditions for infection (consisting in warm weather with intermittent rain and sun) did not prevail during 1932 until late in July. In Scotland (where picking begins about one month later than in England) the earliest pickings were more severely affected than the late ones.

Hitherto it has been assumed that a heavy reduction in the crop of susceptible raspberry varieties from cane spot is chiefly due to injury caused by severe infection of the new canes of the previous year in April and May, with the result that spraying, in any one year, has been carried out to protect the following year's crop. The experience of 1932 shows, however, that under certain seasonal conditions the brunt of the infection is borne directly by the fruits, with considerable injury to the current year's crop. This type of injury provides an additional reason for the yearly application of a delayed-dormant and pre-blossom spray [cf. ibid., x, p. 804].

DEARNESS (J.) & FOSTER (W. R.). **Anther and stigma blight of Loganberry.**—*Canadian Journ. of Res.*, ix, 1, p. 43, 1 pl., 1933.

In the spring of 1932 the junior author observed a white fungus on the anthers and stigmas of loganberries (*Rubus loganobaccus*) in the Royal Oak and Gordon Head districts, Vancouver Island, British Columbia. The pollination of the drupelets was prevented and deformation of the fruit resulted, causing an estimated loss of 3 to 5 per cent. of the crop. The fungus in the distorted flowers was found to agree with *Hapalosphaeria* (*Paepalopsis*) *deformans* Syd. (*Ann. Mycol.*, vi, p. 301, 1908), both the hyphal form and the pycnidial being present. One anther contained 56 pycnidia, each with a multitude of smooth, hyaline, globoid spores, 3 to 4 $\mu$ in diameter. It is believed that this Asiatic parasite of the raspberry reached the American continent by way of the North-west.

MASSEE (A. M.). **Further observations on the Strawberry Tarsonemid mite (Tarsonemus fragariae Zimm.).**—*Ann. Rept. East Malling Res. Stat. 1st Jan. 1932 to 31st Dec. 1932*, pp. 117–131, 3 pl., 1933.

Royal Sovereign strawberries at East Malling which had been completely freed from infestation by mites (*Tarsonemus fragariae*) gradually died during the following season. It is considered to be possible that they were affected by the 'yellow edge' virus disease [*R.A.M.*, xii, p. 519], the symptoms of which would be masked by the effect of heavy mite infestation. The possibility that this mite is a vector of the virus is being investigated.

CRÜGER. **Vorzeitiges Absterben der Johannisbeerblätter.** [The premature dying-off of Currant leaves.]—*Die Kranke Pflanze*, x, 7–8, pp. 106–107, 1 fig., 1933.

Leaf spot of currants (*Pseudopeziza ribis*) [*R.A.M.*, xi, p. 799; xii, pp. 519, 705] is stated to cause heavy damage every summer in the Königsberg district of Prussia, where the red and white Versailles and Fag's Fruitful are accounted susceptible, while a high degree of resistance is shown by the red Dutch and Erstling von Vierlanden varieties. Not only is the current season's harvest greatly reduced by the disease, but the bushes become progressively weaker with each annual attack and finally die. Good control has been effected by an application of 0·8 per cent. Bordeaux mixture shortly after flowering, at a cost of Pf. 1·5 per bush [cf. ibid., xii, p. 640]. In certain circumstances additional treatments before flowering and 14 days after the post-blossom application may be indicated, but in no case should the bushes be sprayed during the flowering period.

Leaf scorch of currants may be due either to factory exhalations, keen, drying winds, shortage of potash, or excess of chlorine in the soil [ibid., xi, p. 463]. The leaf margins of plants affected by potash deficiency tend to turn blackish, whereas in the case of chlorine excess a rust-brown tinge is assumed. Potash should be applied in the form of potassium sulphate (3 kg. per 100 sq. m.), and not in that of kainit or potash salt.

Both *P. ribis* and leaf scorch may also affect gooseberries, on which they should be combated as described above.

WARDLAW (C. W.). **Panama disease. A review of the occurrence of Panama disease on the Cavendish or Dwarf Banana in the Canary Islands.**—*Trop. Agriculture*, x, 6, pp. 151–154, 1933.

This paper is mainly based on the information contained in Del Cañizo's and Sardiña's recent communication on the Panama disease (*Fusarium oxysporum* f. 3 and f. 4 Wr.) of the Cavendish banana (*Musa cavendishii*) in the Canary islands, which has already been noticed in this *Review* [*R.A.M.*, xii, p. 381].

PARK (M.). **Anthracnose of Plantains.**—*Trop. Agriculturist*, lxxx, 6, pp. 387–388, 1 col. pl., 1933.

A brief popular account is given of a form of anthracnose (*Gloeosporium musarum*) [*R.A.M.*, xii, p. 40] of unripe plantains [*Musa paradisiaca*] in Ceylon, which is stated to be commonest in wet weather and to appear soon after the fruits have set. While usually infection starts from the distal end of the fingers, presumably through the flowers, occasionally the rachis of the bunch becomes infected, the disease then spreading into the immature fruits through the stalk end. In both cases the diseased fruit turns black from the point of attack, shrivels and dries, without becoming detached from the rachis. Though sometimes the whole bunch may be affected, more commonly only one or two hands are involved. So far as the author is aware this form of the disease, on unripe fruit, is known to occur only in Ceylon and in India.

At present the disease is not of economic importance in Ceylon, since it attacks chiefly the cooking variety known as the Ash

Plantain which appears to be considerably more susceptible than any of the other varieties commonly grown in that island. Brief notes are given on the control of the trouble by the removal of the first infected parts and spraying with copper fungicides, in case this should prove necessary.

PETHERBRIDGE (F. R.). **Dusting for pest and disease control in the United States and Canada.**—*Journ. Min. Agric.*, xl, 3, pp. 209–215, 1933.

This is a brief report of the observations made by the author during his visit from April to June, 1931, to the United States and Canada, on the results obtained there in the control of fungal diseases and insect pests of fruit trees by means of fungicidal and insecticidal dusts. Much of the information regarding the former has already been noticed from time to time in this *Review*.

MARTIN (H.). **Studies upon the copper fungicides. II. Some modifications of Bordeaux mixture designed to overcome practical difficulties in its application.**—*Ann. of Appl. Biol.*, xx, 2, pp. 342–363, 1933.

This is a detailed account of laboratory and field experiments [a brief reference to which was made in a previous communication: *R.A.M.*, xi, p. 465] conducted in 1931 and 1932 at the South-Eastern Agricultural College, Wye, to test the efficacy and ascertain the drawbacks of two modifications of Bordeaux mixture intended to overcome certain disadvantages inherent in the latter, especially its inferior fungicidal action when applied as a heavy spray or drench instead of a fine mist, and to allow of the incorporation in it of contact insecticides. The first of these modifications consists in the addition of 0·75 per cent. of concentrated sulphite lye (60° Tw.) to the lime suspension before the stock copper sulphate solution is poured into it, and the second in the addition to the lime suspension of an emulsion produced by agitation of a mixture of a glyceride oil [ibid., xii, p. 576] and the copper sulphate solution. The name suggested for the first modification is Bordeaux-sulphite lye, and for the second oil-Bordeaux, to distinguish it from the combination of Bordeaux mixture and oil emulsion prepared with casein or other emulsifier, which is commonly known in America as 'Bordeaux-oil'. In the formulas giving the strength of the latter combination (e.g., 1–10–15–100) the first figure indicates the quantity in gallons of the glyceride oil added to the mixture.

The results of comparative field trials of the two preparations in the control of potato blight [*Phytophthora infestans*], apple and pear scab [*Venturia inaequalis* and *V. pirina*], hop downy mildew (*Pseudoperonospora humuli*), and, with the addition of a contact insecticide, of the apple sawfly (*Hoplocampa testudinea*) and the hop-damson aphis (*Phorodon humuli*), showed, in the case of the fungal diseases, that both, used as a wash, were as effective as lighter mist-like application of Bordeaux mixture; the fungicidal efficacy of the oil-Bordeaux emulsion was in some cases equal to that of a Bordeaux mixture containing double the amount of copper sulphate and lime. In combination with nicotine both modifications controlled the insects as efficiently as nicotine-soap

wash. It was also noted that the application of large quantities of the modified mixtures did not cause greater leaf injury or fruit russeting than lighter applications of Bordeaux mixture. Finally, it is pointed out that the possibility of using sprays of a larger volume, sufficient to drench the foliage, renders the application of the modified Bordeaux mixtures easier and more rapid than the usual mixture.

Estimations (by a method which is described) of the amounts of copper retained on the foliage after spraying [which are shown in comparative tables] showed that the use of oil improves the retention of the spray deposit, a fact which allowed of reducing the content in copper sulphate and lime of the oil-Bordeaux emulsion to half of that in the Bordeaux mixture used in the comparative tests.

THOMAS (R. C.). **A phenol-coefficient study involving bacterial plant pathogens.**—*Ohio Agric. Exper. Stat. Bull.* (Tech. Ser.) 10, pp. 3–14, 1932. [Abs. in *Chem. Abstracts*, xxvii, 18, pp. 4554–4555, 1933.]

A method is outlined for the determination of phenol coefficients of bactericides with Bacto nutrient agar, $P_H$ 7·3, and Bacto nutrient broth, $P_H$ 6·8, as the standard media. The compounds possessing the highest toxic efficiency were the mercury derivatives, mercuric chloride, metaphen, mercury ethyl chloride, and merthiolate [*R.A.M.*, xi, p. 428]. Sulphur derivatives showed greater toxicity to plant than to animal pathogens.

MORSTATT (H.). **Bibliographie der Pflanzenschutzliteratur: das Jahr 1932.** [Bibliography of plant protection literature for the year 1932.]—*Biol. Reichsanst. für Land- und Forstwirtsch.*, Berlin-Dahlem, 259 pp., 1933.

This bibliography of the German and foreign literature published during 1932 on different aspects of phytopathology and plant protection has been compiled on the usual lines [*R.A.M.*, xi, p. 665].

HOPKINS (J. C. F.). **Plant disease and environment in Southern Rhodesia.**—*Trop. Agriculture*, x, 6, pp. 172–177, 1933.

This paper represents an effort to correlate the epidemiology of the diseases attacking cultivated crops in Southern Rhodesia with the environmental conditions prevailing there. The results of the author's observations would indicate that, while climatic factors appear to play a predominating part in the outbreak and development of the diseases, their effects are frequently modified to a greater or lesser extent by subsidiary, but none the less important factors, such as the constitution, whether native or European, of the local population, and also the degree of adaptability of recently introduced crops to their new surroundings. This view is substantiated by field observations and pot experiments on wildfire (*Bacterium tabacum*) and angular spot (*Bact. angulatum*) of tobacco; dry rot (*Diplodia zeae*) and seedling blight (*Gibberella saubinetii* and other fungi) of maize; angular spot (*Bact. malvacearum*) and internal boll rot (*Nematospora coryli*) of cotton; and a few other diseases of lesser commercial importance, all of which

should be easily controllable under the climatic conditions of the colony, while in fact they are perpetuated from year to year owing to the lack of initiative exhibited by some growers and the failure to take adequate steps, such as seed treatment or sanitation of the fields, to keep them in check.

SMITH (K. M.). **Recent advances in the study of plant viruses.**—xii + 423 pp., 1 col. pl., 67 figs., London, J. & A. Churchill, 1933.

The subject-matter dealt with in this attractively got up and handy volume gives a survey of the present position of the knowledge of plant viruses [cf. *R.A.M.*, xii, p. 647], and is intended also to serve as a student's reference book until the progress and correlation of knowledge allows a more comprehensive treatise to be written. Within these limits the subject is exhaustively treated, each chapter being followed by a full bibliography of the relevant original work, a large proportion of which has been noticed in this *Review*. Eleven chapters are given to a general account of the symptoms, properties, transmission, physiology, etc., of virus diseases, their relation to insects being very fully discussed. A chapter on potato virus diseases and two on those of other plants, classified according to the hosts, terminate the book. A special feature is the frequent comparisons made between plant and animal viruses. A useful glossary of the technical terms used in virus investigations is appended. The illustrations are numerous and the letterpress clear and attractively written. The book is one that will be of great interest and value to all plant pathologists.

BULLER (A. H. R.). **Researches on fungi. Volume V.**—xiii + 416 pp., 174 figs., London, Longmans, Green & Co., 1933.

Part I of the present volume of researches on fungi, dealing with the structure and physiology of the mycelium in the higher fungi, may be regarded as a continuation of part II of volume IV. In the first part of chapter I the author discusses the formation of hyphal fusions (four types of which are recognized), and elucidates the development of clamp-connexions. The second part deals with the translocation of protoplasm through the septate mycelium of certain Pyrenomycetes, Discomycetes, and Hymenomycetes, the literature on which is summarized and a comprehensive account given of the writer's studies on the phenomenon in a number of fungi including *Fimetaria fimicola*, *Rhizopus nigricans*, and *Corticium solani*.

The existence of a central pore in each mycelial septum of an Ascomycete, a Basidiomycete, or a Fungus Imperfectus, as established by Wahrlich (*Scripta Bot. Hort. Univ. Imper. Petropol.*, iv, p. 101, 1893), whose work is recapitulated, has been verified by the author's observations, showing that the septa of fungi in general are formed by annular ingrowths from a lateral wall. In respect of protoplasmic continuity, therefore, the higher fungi resemble other plants in that all the living cells composing an individual are connected to form a single mass of protoplasm.

In *F. fimicola* the granular protoplasm of the mycelial cells was

observed to traverse the septa without impediment, and to pass through 'peg-to-peg' fusions (i.e., those taking place between the ends of two very short peg-like hyphae produced opposite to one another on the sides of two older hyphae). When protoplasmic streaming is relatively rapid, the vacuoles may be carried by the current for long distances; the maximum observed rate of protoplasmic flow in *F. fimicola* was estimated at 6 cm. per hour. In the compound mycelium of *Pyronema confluens* the protoplasm was seen to flow through 161 cells in succession and through three fusion passage-ways, thus affording ocular confirmation of the supposition (Researches on Fungi, iv, p. 182, 1931) that a function of hyphal fusions is to facilitate the transfer of food materials from one part to another of the mycelium. Experimental observations on pore plug formation in *F. fimicola* and *P. confluens* showed that the protoplasm of a cell injured by a needle always died throughout its length right up to its two septa, the pores of which became blocked by a plug.

Of special interest to phytopathologists is chapter II of part II (in collaboration with T. C. Vanterpool), which is concerned with the violent discharge of the basidiospores (the secondary conidia of authors) of *Tilletia tritici* [*T. caries*], the causal organism of wheat bunt [*R.A.M.*, xi, p. 289]. The discharge of the conidium with drop-excretion exactly resembles the corresponding processes in the Hymenomycetes and Uredineae, indicating that the falcate secondary conidia of the bunt organism are true basidiospores. Further evidence in support of this theory is furnished by a study of the comparative morphology of the basidial apparatus in the Tilletiaceae. A new terminology for *T. caries* is accordingly proposed, in which the whole product of a chlamydospore (basidium-body, primary and secondary sterigma, and primary basidiospore) will be known as a basidium, replacing Brefeld's concept of the latter as merely the promycelium and primary conidium or basidiospore. Secondary basidiospores are those produced on mycelial sterigmata. The primary basidiospores have two nuclei of opposite sex, and at this stage the fungus is homothallic. Into the secondary basidiospores, however, only one of the paired nuclei passes and the mycelium from them is haploid. At this stage the fungus appears to be heterothallic and the fusion between the two haploids of opposite sex probably occurs in the tissues of the host. In experiments with *T. caries* basidiospores were discharged horizontally to a distance of 1·2 to 1·4 mm. which is further than in any other known Basidiomycete. In the so-called 'spore-fall' method of inoculation, an agar slope with an active mycelial mat on its surface is inverted over wheat grains, which are thus exposed to the falling basidiospores shot away from their sterigmata. In contact with the primary leaf sheaths of the seedlings, the basidiospores readily germinate and produce mycelia. A considerable proportion of wheat plants inoculated by this method with *T. caries* and *T. levis* [*T. foetens*] yielded bunted heads, thereby proving that the secondary basidiospores in multiple inoculations are capable of causing bunt balls to form.

Chapters I and III of part II are devoted, respectively, to *Sporobolomyces*, a Basidiomycetous yeast-genus, and the *Sphaerobolus*

gun and its range. The volume concludes with a general summary of the outstanding results of the studies.

RISCHKOW (V. L.) & KARATSCHEWSKY (I. K.). **Chlorophyllmangel und Enzymwirkung. I. Katalasewirkung bei Panaschierung und Mosaikkrankheit.** [Chlorophyll deficiency and enzymatic action. I. Catalase action in variegation and mosaic disease.]—*Beitr. Biol. der Pflanzen*, xx, 3, pp. 199–220, 1 fig., 1933.

The results [which are tabulated and discussed] of investigations at Simferopol, Russia, on the catalase action in mosaic as compared with healthy potato and tomato leaves showed a reduction in the former in the proportion, on an average, of 1 : 2·7. The diseased material consisted of Wohltmann potatoes affected probably by the 'streak' form of mosaic [*R.A.M.*, xii, p. 716] and tomatoes (*a*) suffering from cucumber mosaic with fern-leaf and filiform leaves [ibid., xii, pp. 540, 731], and (*b*) artificially inoculated with potato mosaic. A corresponding, but in some cases much heavier, reduction was observed in the catalase action of variegated white and yellow foliage in a number of plants [which are listed].

HATCH (A. B.) & HATCH (C. T.). **Some Hymenomycetes forming mycorrhizae with Pinus strobus L.**—*Journ. Arnold Arboretum*, xiv, 3, pp. 324–334, 4 pl., 1933.

Full details are given of the authors' synthesis of mycorrhiza carried out partly at Melin's Laboratory in Stockholm and partly at Harvard University, following in general on the lines of Melin's work [*R.A.M.*, iv, p. 430]. Typical ectotrophic mycorrhiza were formed with *Pinus strobus* by the use of pure cultures of the following twelve fungi: *Lactarius chrysorheus* (Pennsylvania), *L. deliciosus* (Djursholm, Sweden) [ibid., xii, p. 386], *Amanita muscaria* (Djursholm), *Boletus castaneus* (Pennsylvania), *B. bovinus*, *B. luteus*, *B. granulatus* (all three from Djursholm), *Boletinus porosus* (Pennsylvania), *Mycelium radicis nigrostrigosum*, *M. r. abietis 1*, *M. r. strobi 1*, and *M. r. sylvestris 1* (all from Sweden). *M. r. atrovirens* overgrew the aerial parts of the seedlings and exhibited no indications of mycorrhizal formation. In some of the cultures *M. r. nigrostrigosum* and *M. r. abietis 1* were associated with the same seedling, each fungus forming typical mycorrhiza with short roots, while the former also produced a secondary mantle over several mycorrhiza of the latter type.

GÜNNEWIG (J.). **Beiträge zur Kenntnis und Bedeutung des Loliumpilzes.** [Contributions to the knowledge and importance of the *Lolium* fungus.]—*Beitr. Biol. der Pflanzen*, xx, 3, pp. 227–254, 1933.

A full account is given of the writer's studies at Lette, Westphalia, on the fungal infection of *Lolium* seed, represented by *L. temulentum*, *L. remotum*, *L. perenne*, and *L. multiflorum* from Germany and other countries [*R.A.M.*, x, p. 477]. The amounts of infection on *L. temulentum* (ranging from 0 in Palestine material to 98 per cent. in that from Liège, Belgium) are stated to approximate to the figures given by other workers, whereas *L. multi-*

*florum* (all German samples) was more extensively invaded (87 to 99 per cent.) than indicated in the literature. Only one sample of *L. perenne*, from Leningrad, out of a number tested showed infection and *L. remotum* (one sample) was free from fungus. A repetition of Fuchs's experiments (*Hedwigia*, li, p. 221, 1912) failed to disclose the presence of a *Fusarium* in the seeds.

In bouillon cultures of seed sterilized with calcium hypochlorite a mycelium appeared at the point of emergence of the seedling from the seed and this was transferred to a number of different media; on several of these [details of which are given] it fructified freely. The fungus proved to be a *Chaetomium* with perithecia 140 to 200 by 90 to 135 $\mu$, asci 30 to 40 by 14 to 18 $\mu$, and olive-brown ascospores 9·5 to 10·5 by 6 to 8 $\mu$. It resembled *C. murorum* or *C. spirale*, but was identified at the Centraalbureau voor Schimmelcultures as *C. kunzeanum* Zopf. The same species was isolated from all the samples of *L. temulentum*, *L. multiflorum*, and *L. perenne* irrespective of their origin.

*C. kunzeanum* grew poorly on media lacking nitrogen and both infected and uninfected *Lolium* seeds were also found to require nitrogen for their development. It is considered improbable that *C. kunzeanum* binds free atmospheric nitrogen or assimilates free nitrogen in symbiosis with *L. temulentum*.

Inconclusive results were given by experiments in the inoculation of *Lolium* plants with the fungus. Infected *L. multiflorum* plants tiller less freely than healthy ones during the first year, but in contrast to uninfected individuals they form ears at this age, showing the presence of the fungus. In the second year tillering is normal and the ears are free from infection. The effects on *L. temulentum* were less conspicuous, consisting merely in a retardation of growth and a tendency to produce chlorosis.

BALDACCI (E.). **Studi sulla fitoimmunità acquisita attiva.** [Studies on the active acquired immunity of plants.]—*Boll. R. Ist. Sup. Agr. di Pisa*, viii, pp. 457–472, 9 graphs, 1932. [Received October, 1933.]

After briefly summarizing the results of Jarach's experiments on the artificial immunization of beans [*Phaseolus vulgaris*] against *Botrytis cinerea* [*R.A.M.*, xi, p. 798] the author describes a test in which *Acrostalagmus cephalosporioides*, *Macrosporium commune*, *Aspergillus niger*, and *Botrytis cinerea* were grown in a synthetic nutrient solution and three kinds of 'vaccines' were obtained from them (prepared (*a*) by passing the culture liquid through a Chamberland filter, (*b*) from the filtrate after trituration of the mycelium with sand, and (*c*) from the residue of the ground mycelium and sand), in which seeds of Gentil rosso wheat, lucerne, and clover were germinated on sand or moistened cotton wool, fresh vaccine being added from time to time. Only the vaccines prepared by the first method retarded germination and reduced its percentage to any appreciable extent, this toxic effect being attributed to the presence of the metabolic waste products of the mycelium. The result agrees, on the whole, with that reached by De Paolis, working with metabolic products of a *Pythium* [ibid., xi, p. 164].

When seed of three wheat varieties was grown in the filtered

culture liquid from the first three fungi and only the one application of the vaccine was made, a very high percentage germination (71 to 100 per cent.) resulted, indicating that the previous toxicity of the vaccine was due to repeated application, and that when the dosage was reduced or diluted the toxicity was attenuated. The retarding effect on germination was, however, confirmed.

Twelve-day-old wheat seedlings germinated in water and transferred to the filtered vaccine obtained from *B. cinerea* made very poor growth as compared with the controls, the injury being in proportion to the concentration of the vaccine. One week after transference to fresh Knop's solution, however, all the seedlings except those grown in undiluted vaccine or in equal parts of vaccine and water resumed active growth. A fortnight later they were inoculated with a young culture of *B. cinerea*, and all developed symptoms of disease. The leaves rapidly turned yellow and died, the mycelium penetrating the tissues and being visible at the edges of the inoculation wound. Similar results were obtained with *A. cephalosporioides* and *M. commune.*

In the author's opinion, these results do not support Jarach's view that vaccinal immunity in plants is a vital, specific phenomenon.

BUNSCHOTEN (GERHARDA E.). **Invloed van de voeding op de virulentie van schimmels.** [The influence of nutrition on the virulence of fungi.]—*Thesis, University of Utrecht* (Hollandia-Drukkerij, Baarn), 63 pp., 5 pl., 2 graphs, 1933.

A comprehensive and extensively tabulated account is given of the writer's investigations on the influence of nutrition on the virulence of *Sclerotinia sclerotiorum* and *Rhizoctonia* [*Corticium*] *solani*, tomato seedlings being used as the test plant for the former and *Brassica chinensis* for the latter.

The virulence of 8- to 21-day-old cultures of *S. sclerotiorum* was tested to determine the effect of various nitrogen compounds, two strains of the fungus being used, one from the Centraalbureau at Baarn isolated from lettuce in 1922, and the other supplied by W. H. Whetzel from *Phaseolus lunatus* in the United States in 1931. The two strains differed little in their response as regards virulence to growth on a number of standard media, and showed a high degree of virulence after culture on peptone-glucose-saccharose agar for 8 or 14 days. After 18 days' culture on this medium virulence was lost. In tests on synthetic media with different sources of nitrogen it was found that ammonium compounds produced the greatest virulence, followed by urea and asparagin. Among the carbohydrates (using ammonium sulphate as a source of nitrogen), saccharose, glucose, fructose, galactose, dextrin, maltose, and lactose conferred almost equal virulence on the cultures. Cellulose, soluble starch, and gum arabic led to loss of virulence. The accumulation of toxic metabolic products from the ammonium compounds, especially from peptone media, led to loss of virulence with age, the effect being visible from 14 days in culture onwards. These toxic effects of the ammonium compounds may be counteracted to some extent by the addition of sugar to the medium, enabling the fungus to resume the utilization of ammonium. After six months' growth on 4 or 40 per cent. saccharose agar, and then fresh sub-

culturing, the virulence of the cultures had declined to such an extent that they were useless for inoculation. A similar effect was observed after a year on malt salep, but on the other media the virulence of the fungus did not suffer from uniformity of nutriment for prolonged periods.

The strain of *C. solani* used in the writer's experiments was isolated by A. van Luijk from grass seed in 1931, and is identified, in accordance with K. S. Thomas's classification [*R.A.M.*, iv, p. 443] as *R. s. graminis*. The fungus made profuse growth on a number of natural and synthetic media and maintained its infective powers undiminished up to nearly three weeks in unchanged culture. It readily utilized different nitrogenous compounds, such as 0·5 per cent. ammonium sulphate, 0·5 per cent. ammonium chloride. and 0·4 per cent. ammonium nitrite, and was equally virulent with all those tested. Soluble starch was a very good source of carbon for maintaining virulence, as were also dextrin, gum arabic, saccharose, maltose, and glucose; lactose was found, however, to be definitely unsuitable for this purpose. At the age of three weeks the virulence of the cultures was generally declining, with the exception of those receiving soluble starch and ammonium sulphate as sources of carbon and nitrogen, respectively. Protracted uniformity of nutriment did not reduce the pathogenicity of *R. s. graminis* in cultures on potassium nitrate, ammonium chloride, ammonium sulphate, peptone, and asparagin as sources of nitrogen.

DE JAGER (H.). **Ziekteverschijnselen van enkele cultuurgewassen als gevolg van den inwerking van keukenzout.** [Pathological phenomena in some cultivated plants as a result of the action of cooking salt.]—*Thesis, University of Utrecht* (Hollandia-Drukkerij, Baarn), 95 pp., 12 pl., 2 figs., 1933. [English summary.]

A comprehensive and fully tabulated account is given of the writer's investigations on the pathological phenomena induced by the action of sodium chloride on wheat, rape seed, peas, and tobacco in water cultures.

A comparison of the effects of sodium nitrate, sodium sulphate, potassium chloride, and calcium chloride indicated that similar symptoms to those described for sodium chloride injury could be induced in the different plants by some or all of these salts.

HALL (MURIEL P.). **An analysis of the factors controlling the growth form of certain fungi, with especial reference to Sclerotinia (Monilia) fructigena.**—*Ann. of Botany*, xlvii, 187, pp. 543–578, 2 pl., 6 graphs, 15 diags., 1933.

After a brief review of the work previously done in the study of the phenomenon of zonation or 'ringing' in various fungi, the author gives a detailed account of her controlled experiments with *Sclerotinia fructigena*, *S. laxa*, *S. fructicola*, and *Fusarium fructigenum*, the results of which showed that in these fungi zonation is mainly caused by alternations of light and darkness (the minimum length of exposure to light necessary to cause zoning varying with the specific fungus), and in *S. fructigena* and *F. fructigenum* also by alternations of high and low temperatures in darkness.

In *S. fructigena* zones were formed only in media of an acidity equal to or more acid than $P_H$ 6.

DICKINSON (S.). **The nature of saltation in Fusarium and Helminthosporium.**—*Minnesota Agric. Exper. Stat. Tech. Bull.* 88, 42 pp., 6 figs., 1932. [Received September, 1933.]

Considerable details are given of experiments with *Helminthosporium pedicellatum*, *H. monoceras*, a species of the *H. brachysporium* type, *Fusarium fructigenum*, and *F. vasinfectum*, for the purpose of ascertaining some of the causes underlying the phenomenon of saltation in fungi. Preliminary studies showed that all the numerous nuclei present in the conidia of the species of *Helminthosporium* investigated originate from a single one, and that in the *Fusarium* species each cell in both the conidia and the mycelium contains only one nucleus. When cells or conidia, either containing one nucleus or arising from one nucleus, were isolated by the microscissors method [*R.A.M.*, xii, p. 579], they invariably produced colonies similar to those of the parent strains, and on further isolations, these strains were shown to give rise to saltant forms under appropriate conditions. This fact is considered to indicate that in the species studied saltation is not due to heterocaryosis.

During the course of the work, attempted or perfect hyphal fusions were observed between almost all of the strains used, and details are given of the procedure adopted to obtain such fusions. The study, in particular, of the fusion cells formed between pairs of cells of two contrasting strains of *F. fructigenum* (one of which had arisen by saltation from the other), in the process of whose formation the cytoplasms of the two parent strains are assumed to have thoroughly mixed with each other, showed that on isolation such fusion cells gave rise to growths in which the cultural characters of one or other of the two parent strains were found unchanged, no intermediate or new forms being produced, an observation which suggests that the difference between the latter is not of a cytoplasmic nature. Taken in conjunction with the disproval of heterocaryosis, this fact tends to show that in *F. fructigenum* saltation was caused by a change in the nucleus, and was therefore a mutation, but whether due to a chromosomal aberration or a gene change cannot yet be determined.

DAS GUPTA (S. N.). **Formation of pycnidia in Cytosporina ludibunda by the intermingling of two infertile strains.**—*Ann. of Botany*, xlvii, 187, pp. 689–690, 1933.

In this brief note the author states that two saltant strains ($CA_2$ and $CA_4$) of *Cytosporina ludibunda* [*R.A.M.*, xii, p. 573], which are infertile when kept separately, have been now found to produce pycnidia in mixed cultures of the two, but attempts to determine whether or not hyphae of the two strains fuse together before the formation of the pycnidia have so far proved unsuccessful.

ALLEN (RUTH F.). **A cytological study of the teliospores, promycelia, and sporidia in Puccinia malvacearum.**—*Phytopath.*, xxiii, 7, pp. 572–586, 4 figs., 1933.

In *Puccinia malvacearum*, the well-known rust of hollyhocks

and other Malvaceae [*R.A.M.*, x, p. 259], teleutospores are formed by binucleate basal cells, each of which by branching may give rise to several spores in succession. Each spore initial divides into spore and stalk cell, the former of which again divides to produce the bicellular spore. Fusion occurs between the two nuclei in each cell of the spore, between the two large nucleoli in the fusion nucleus, and possibly the chromatin strands become paired. After migration into the young promycelium the nuclear membrane disappears and the chromosomes (probably numbering five) lie scattered in the cytoplasm. The spindle forms and the nucleus divides with the passage of the (apparently 5) daughter chromosomes to each pole. The promycelium is divided by a cell wall into two cells, and a second nuclear and cell division promptly follows. Each cell extrudes a broad beak at its upper end, which swells at its tip to form the sporidium. The nucleus passes out into the young sporidium and divides, the later stages of the division succeeding the discharge of the sporidium. Mature sporidia are regularly binucleate.

VOLKART (A.). **Abbau und Viruskrankheiten.** [Degeneration and virus diseases.]—Reprinted from *Landw. Vorträge*, 55 pp., 1933.

This is a discussion of the current theories concerning the nature of potato degeneration (with special reference to H. Morstatt's ecological hypothesis, followed up and amplified by F. Merkenschlager *et al.*) [*R.A.M.*, iv, p. 426; xi, p. 395 *et passim*], and its connexion with virus diseases, the most recent investigations on which are concisely summarized under the headings of filterability, size, nature of the agents, characteristic properties, relations with the host, and insect transmission. The author is satisfied that potato degeneration as observed in Switzerland is entirely to be attributed to the influence of virus diseases.

COCCHI (F.). **Ricerche sulla 'scabbia' delle Patate.** [Researches on Potato scab.]—*Boll. R. Staz. Pat. Veg.*, N.S., xiii, 1, pp. 74–139, 2 figs., 1933. [English summary.]

The author gives a very full account of the morphology and physiology of three strains of *Actinomyces* isolated from common scab of potatoes or from the earth adhering to the scabs, one of which was identified as *A. flavus*, another as *A. clavifer*, while the third (referred to as Aa) could not be identified as belonging to any of Millard's and Burr's species [*R.A.M.*, vi, p. 179; xi, p. 200].

On the same media each strain retained its cultural characters even after a long series of transfers, the colonies losing, however, their reproductive power after four months. All three organisms grew at a range of hydrogen-ion concentrations from $P_H$ 5 or 5·6 to about 9, with an optimum of 7 to 7·5, and at a temperature range of 10° to 40° C., with an optimum of about 25° to 30°. The best source of nitrogen was nitrates and the best carbohydrate was glucose. They produced different amounts of proteolytic enzymes, sucrase, maltase, lactase, amylase, and cellulase; they did not produce tyrosinase or lipase, acids or bases, and did not attack

cork, or penetrate the cut surfaces of potato tubers once suberization had been completed.

The paper concludes with a brief account of recent researches into the host-parasite relationship in potato scab, varietal resistance, the effect of environmental factors on infection, and control. A bibliography of 89 titles is appended.

REDDICK (D.). **A Potato disease.**—*Phytopath.*, xxiii, 7, pp. 622–624, 1 fig., 1933.

A brief description is given of a virus-like disease of potatoes at Ithaca, New York, which was found to be due to infestation by a mite of the genus *Tarsonemus* and which corresponded, except for minor variations, with one described by Carpenter in Hawaii in 1918 and by Mann and others in India (where it is known as 'tambera' disease) in 1920. The mites are microscopic in size and scarcely seem abundant enough on the foliage to account directly for the profound changes induced in the plants.

GIGANTE (R.). **Nota preliminare sulla 'necrosi del cuore' dei tuberi di Patata.** [A preliminary note on heart necrosis of Potato tubers.]—*Boll. R. Staz. Pat. Veg.*, N.S., xiii, 1, pp. 155–159, 1 fig., 1933. [English summary.]

When potato plants were grown in Italy from tubers of the Böhms Allerfrüheste Gelbe variety affected with the non-parasitic heart necrosis recently reported from Germany, as characterized by an internal brown spot sometimes developing into a large cavity [*R.A.M.*, xi, p. 534], they remained sickly and stunted, and produced only a few small tubers of which 14 to 58 per cent. were affected by heart necrosis. It is therefore concluded that the condition is hereditary.

HEMMI (T.). **Experimental studies on the relation of environmental factors to the occurrence and severity of blast disease in Rice plants.**—*Phytopath. Zeitschr.*, vi, 3, pp. 305–324, 8 figs., 1933.

The writer here summarizes in English the results of investigations conducted in Japan by himself and his students on the blast disease of rice (*Piricularia oryzae*) [*R.A.M.*, xii, p. 532], most of which have already been noticed in this *Review*. It is considered that the known influence of low soil temperatures in increasing the disease is due to the reaction of the host plant, not the parasite, the highest degree of resistance being shown at temperatures (about 28° C.) most favourable to the growth of rice, while at 20° C. the normal metabolism of the host is impeded and susceptibility increases. Attention is drawn to a point on which further studies (with H. Suzuki) are in progress, namely, the connexion between resistance to blast and the capacity for absorption of silicates from moist soils.

MURRAY (R. K. S.). **A note on sun-scorch of budgrafts.**—*Trop. Agriculturist*, lxxx, 6, pp. 349–351, 1933.

The author states that in March, 1933, cracking due to sunscorch of the bark on the raised portion of the 'elephant foot' of

bud grafts of *Hevea* rubber [*R.A.M.*, xii, p. 591] again occurred at the Experiment Station, Nivitigalakele, Ceylon. In several instances the lesion thus formed was invaded by *Botryodiplodia theobromae*, which extended the damage several inches up the scion and into the wood. The condition may be prevented by the avoidance of exposure to the direct rays of the sun.

SANFORD (G. B.). **Some soil microbiological aspects of plant pathology.**—*Scient. Agric.*, xiii, 10, pp. 638–641, 1933. [French summary.]

The author discusses briefly the variations following different cultural practices (e.g., crop rotation and fallowing) in the virulence of, and intensity of attack by, certain soil-inhabiting pathogenic micro-organisms on the underground parts of plants. In pointing out the importance of this problem in the study of control measures against certain soil-borne diseases of cultivated crops, such as the various foot rots of cereals, common scab (*Actinomyces scabies*) and *Rhizoctonia* [*Corticium solani*] stem canker of potatoes, and the like, he stresses the necessity of determining whether the reduction in the intensity of attack brought about by a given cultural method is due to an actual decline in the numerical strength of the pathogens caused by resulting uncongenial environmental conditions, or to modifications in the virulence of the parasites caused by the action on them of other antagonistic micro-organisms, the development of which is favoured by these conditions [cf. *R.A.M.*, xii, p. 684].

DEMETER (K. J.) & MOSSEL (H.). **Über die Brauchbarkeit von Cholodnys mikroskopischer 'Aufwuchsplattenmethode' bei mikrobiologischen Boden-Untersuchungen.** [On the applicability of Cholodny's microscopic 'slide growth method' to microbiological soil investigations.]—*Zentralbl. für Bakt.*, Ab. 2, lxxxviii, 17–22, pp. 384–393, 2 pl., 1933.

The results of manuring experiments on potatoes and beets at Weihenstephan, Bavaria, indicated that Cholodny's microscopic 'slide growth method' [*R.A.M.*, xii, p. 324] is better adapted than any other process for the observation of certain qualitative and quantitative changes in the soil microflora. The advantages and drawbacks of the method are discussed and some suggestions made for its improvement.

BEARD (F. H.). **Symptoms of manurial deficiencies in Hops.**—*Ann. Rept. East Malling Res. Stat. 1st Jan. 1932 to 31st Dec. 1932*, pp. 156–158, 1 pl., 1933.

Brief descriptions are given of the foliage characters shown by hop plants grown for three seasons in pots containing pure sand and fed with the following nutrient solutions, viz., (1) complete nutrient solution, (2) nitrogen omitted, (3) potassium omitted, (4) phosphorus omitted, (5) calcium omitted, (6) magnesium omitted, (7) rain water only [cf. *R.A.M.*, ix, p. 415]. The symptoms (which were also marked in field tests) allow of the ready identification of the various nutritional deficiencies.

SUMMERS (E. M.). **Mosaic disease in Co. 281 Cane.**—*Sugar Bull.*, xi, 23, pp. 3–4, 1933. [Abs. in *Facts about Sugar*, xxviii, 10, p. 398, 1933.]

The Co. 281 sugar-cane variety, hitherto regarded as specially valuable under Louisiana conditions, is stated to be contracting mosaic in a serious form [cf. *R.A.M.*, xi, p. 604], necessitating careful seed selection. The risks of a spread of infection by this variety are considered to be graver than in the case of the P.O.J. canes. It is recommended that Co. 281 be grown in special plots, from which the affected stools are periodically rogued by an expert.

FAWCETT (G. L.). **Las rayas blancas de las hojas de la Caña de Azúcar.** [The white stripes of Sugar-Cane leaves.]—*Rev. Indust. y Agric. de Tucumán*, xxii, 11–12, pp. 299–302, 1 fig., 1932. [Received October, 1933.]

In the spring of 1931 sugar-cane leaves in Tucumán, Argentine Republic, developed white stripes, 1 to 8 mm. in width, sometimes extending the whole length of the leaf and almost covering it. The only leaves exempt from the striping were the two smallest near the base of the plant. Some shoots of affected plants were completely white and generally died on reaching a height of 20 to 30 cm. It was thought that the phenomenon might be due to the action of low temperatures [cold chlorosis: *R.A.M.*, vii, p. 808; xii, p. 329], but the experimental exposure of cane shoots to a range of 4° to 8° C. for periods of four to six hours failed to produce the effects observed in the field. It is concluded that the condition (which caused little damage and did not recur in 1932–3) represents a genetic mutation of unknown origin involving the embryonal cells near the growing point.

FAWCETT (G. L.). **Notas sobre las enfermedades de la Caña de Azúcar.** [Notes on Sugar-Cane diseases.]—*Rev. Indust. y Agric. de Tucumán*, xxiii, 3–4, pp. 68–69, 1933.

The sugar-cane varieties most widely cultivated in Tucumán, viz., P.O.J. 36 and 213, are stated to be completely infested by mosaic [*R.A.M.*, xii, p. 594]. Satisfactory results have been obtained at the Experiment Station with the recently introduced immune varieties P.O.J. 2878 and 2725 as well as with some from Coimbatore, India. Notes are also given on cold chlorosis and on the newly observed white striping of obscure origin [see preceding abstract].

MUNGOMERY (R. W.) & BELL (A. F.). **Fiji disease of Sugar Cane and its transmission.**—*Queensland Bureau of Sugar Experiment Station, Div. of Path. Bull.* 4, 28 pp., 8 figs., 1933.

After a brief historical review of the Fiji disease of the sugar-cane, in which the trouble is stated to have been first observed in Fiji, but is believed to have originated in New Guinea or adjacent islands, and to have been since reported, in addition, from the Philippine Islands, Australia, and Java (where it was found only in the quarantine garden), the authors give a description of the symptoms caused by it, with particular reference to the intracellular inclusions or X-bodies which are present in the cells of the

abnormal tissue [*R.A.M.*, iii, p. 606]. In a discussion of the control measures in general use in Australia, it is stated that none of the chief sugar-cane varieties so far tested by the authors has exhibited high resistance to Fiji disease, and a list is given, as arranged by North, of 19 varieties ranging from moderately resistant to susceptible. In trial plots in Fiji and New South Wales the later P.O.J. canes of the Kassoer 'blood line' [ibid., viii, p. 404; xi, p. 266], the introduction of which into Queensland was contemplated because of their high resistance to the gumming disease [*Bacterium vascularum*], have given indications of being much more susceptible to the Fiji disease than any of the varieties now commercially grown in Queensland [see next abstract].

All attempts to transmit the disease by mechanical methods, including Bonazzi's diseased plug method [ibid., vi, p. 184], gave negative results, but controlled experiments with the insects *Perkinsiella saccharicida*, *Aphis sacchari*, and *Trionymus sacchari* [ibid., xi, p. 327] in insect-proof cages and in trial plots showed that the disease is readily transmitted by the nymphs of *P. saccharicida* which have been bred upon Fiji diseased canes. The incubation period appears to be rather long, approaching two months. It has not yet been established whether the adult insects developed from infective nymphs are also capable of transmitting the disease to healthy canes, as the experiments with adults have hitherto failed. In no case was the disease transmitted by *A. sacchari* or *T. sacchari*.

Systematic field observations have shown that the visible spread of Fiji disease under natural conditions in Queensland is greatest in the hotter and wetter months of the year, and is most rapid where conditions are most favourable for the growth of the sugar-cane. A direct correlation has been found between the rate of spread of the disease and the numerical strength of the *P. saccharicida* population.

**The Java Wonder Cane. A warning to Cane-growers.**—*Queensland Agric. Journ.*, xxxix, 6, pp. 259–260, 1933.

Tests recently carried out in Queensland showed that under local conditions the P.O.J. 2878 sugar-cane is extremely susceptible to downy mildew [*Sclerospora sacchari*: *R.A.M.*, x, p. 339], almost all the propagation plots of this variety laid down in areas where the disease is prevalent having been condemned. In the extreme north of Queensland, where, under favourable climatic conditions, top rot [loc. cit.] appears, this cane is certain to suffer heavily, as it is highly susceptible to this disease also. In those parts of the Fiji Islands where Fiji disease [see preceding abstract] occurs, the P.O.J. 2878 canes have also been exterminated [cf. ibid., x, p. 622; xi, p. 541]. To pokkah boeng [*Gibberella moniliformis*] the variety is as susceptible as its sister cane P.O.J. 2714 [ibid., viii, p. 338; xii, p. 328], and although this disease is at present only of minor importance in Queensland, it might become serious were susceptible canes to be extensively grown. P.O.J. 2878 is, however, very useful in the presence of mosaic and gumming [*Bacterium vascularum*: ibid., xi, p. 327], being more resistant to the latter than any other cane variety in Queensland.

**Sección de Botánica y Fitopatologia.** [Botanical and Phytopathological Section.]—*Informe Anual Estac. Exper. Insul. Dept. Agric. y Com. Puerto Rico 1931–32*, pp. 36–37, 1933.

A severe outbreak of gummosis [*Bacterium vascularum*: see preceding and next abstracts] occurred in the sugar-cane plantations of Vieques, while slighter attacks were reported on the Cristalina, Rayada, and H. 109 varieties in the Rio Piedras district of Porto Rico. 'Fourth disease' [*R.A.M.*, xii, p. 593], mottled stripe, leaf stipple, and Pahala blight [ibid., xi, p. 328] have been definitely identified on sugar-cane in Porto Rico; these disturbances have been under observation for seven, four, nine, and nine years, respectively. False scald [ibid., xii, p. 593] is of very rare occurrence on the Island.

Wiles (D. R. D.). **Section VI. Administrative and experimental work. Control of pests and diseases.**—*Barbados Agric. Journ.*, ii, 1–2, pp. 11–15, 1933.

Notes are given by the Plant Diseases Inspector on the present position in regard to mosaic of sugar-cane in Barbados and the measures for its control. Symptoms of gumming disease [*Bacterium vascularum*: *R.A.M.*, x, p. 127 and preceding abstracts] were observed in January, 1933, in a young crop of the Ba. 11569 variety planted in the previous November. So far, however, no complaints have been received from factories concerning difficulty in the manufacture of sugar from affected canes.

Tehon (L. R.). **Notes on the parasitic fungi of Illinois.**—*Mycologia*, xxv, 4, pp. 237–257, 1 pl., 1933.

Continuing his series of notes on the parasitic fungi of Illinois [*R.A.M.*, ix, p. 62], the writer describes 23 species (20 new with four new genera, provided with Latin and English diagnoses), the following being of phytopathological interest. *Microthyriella rubi* [ibid., xi, p. 61] from *Rubus argutus* apparently represents the ascigerous stage of *Leptothyrium pomi* [ibid., xi, p. 657]. *Aristastoma concentrica* n. g., n. sp. produced alternate red and white, concentrically zonate lesions on cowpea leaves. The spherical to applanate pycnidia, 180 to 270 $\mu$ in diameter, with a circular ostiole, 25 to 35 $\mu$ in diameter, occur exclusively in the white zones and are crowned by a ring of dark-coloured, blunt, straight, septate setae, 20 to 65 by 6·5 to 10 $\mu$; the oblong, 1- to 4-, mostly 3-septate pycnospores measure 15 to 35 by 4·5 to 6 $\mu$. *Cribropeltis citrullina* n. g., n. sp., an agent of 'fly speck' on watermelon fruits, may be recognized by its brown, septate, straight, profusely branched mycelium with hyphae 3 to 4 $\mu$ in diameter; black, irregularly circular pycnidia, 300 to 600 $\mu$ in diameter; simple, hyaline, clavate conidiophores, 5 to 6 by 2 to 3 $\mu$; and simple, hyaline, oblong, straight or slightly curved conidia, 10 to 15 by 4 to 5 $\mu$.

Unamuno (L. M.). **Enumeración y distribución geográfica de los Esferopsidales conocidos de la Península Ibérica y de las Islas Baleares, Familia Esferioidáceos.** [Enumeration and geographical distribution of the Sphaeropsidales recognized in

the Iberian Peninsula and Balearic Islands, family of Sphaerioidaceae.]—*Mem. Acad. Ciencias Madrid, Ser. Ciencias Nat.*, iv, 458 pp., 1933.

An annotated list is given of 1,695 species of Sphaeropsidales (family Sphaerioidaceae) hitherto recognized in the Iberian Peninsula and Balearic Islands, alphabetical indices of the species and hosts and a ten-page bibliography being appended.

KLEBAHN (H.). **Ueber Bau und Konidienbildung bei einigen stromatischen Sphaeropsideen.** [On the structure and conidial formation of some stromatic Sphaeropsideae.]—*Phytopath. Zeitschr.*, vi, 3, pp. 229–304, 106 figs., 1933.

In 1922 a consignment of young Douglas firs (*Pseudotsuga douglasii*) [*P. taxifolia*] was returned to the large forest nursery at Holstenbek, Holstein, from which they were procured, in consequence of their diseased condition.

On examination of this material the writer found a number of fungi, but the inoculations that he was able to carry out with these gave negative results. Detailed morphological studies on cultures of several *Phoma*-like species found on the diseased material led to the formation of a new genus, *Allantophoma*, for three, while a fourth is considered to be a *Phomopsis*, *P. microspora* n. sp. *A. endogenospora* n. g., n. sp. is characterized by spherical to irregular pycnidia, nearly always with projecting corners or angles, the spherical 250 to 300 $\mu$ in diameter and the irregular 250 to 330 $\mu$ in height by 350 to 400 $\mu$ in width, and by elongated-cylindrical, allantoid, continuous conidia measuring 7 to 10 by 2 to 2·5 $\mu$ arising directly from the cells of the whole of the inner wall lining an irregular cavity formed by the dissolution of an originally solid stroma, the outer cells of which are distinctly plectenchymatous, except in the upper part where they are pseudoparenchymatous. The conidia are formed endogenously in the cells lining the cavity and are set free by the dissolution of the cell wall. In *A. exogenospora*, on the other hand, the conidia are borne on well-marked conidiophores; in size and structure the fruit bodies of this species resemble those of the preceding. *A. nematospora* is characterized by irregularly spherical or ellipsoid pycnidia, 250 to 340 $\mu$ in height by 300 to 350 $\mu$ in width (sometimes only 270 by 200 $\mu$). Unlike the two foregoing species, this is furnished with a broadly conical papilla which may be up to 120 $\mu$ in height and 210 $\mu$ in width, but is usually 50 to 80 by 90 to 120 $\mu$. The size and shape of the conidia agree almost exactly with those of two previous species, but in *A. nematospora* a filiform appendage, about equal in length to the conidium, is present. The mode of origin of the conidia in this species is very complex, two quite distinct structures apparently giving rise to these spores, viz., columnar, conical, or irregular cell groups projecting from the cavity wall, mostly separated by lacunae but occasionally united to form a loose tissue; and flat protuberances composed of short, palisade-like or actinomorphic cell layers. The connexion, if any, between these two types of structure and their relation to the process of conidial formation have not yet been clearly traced and

it is not certain whether the conidia are formed endogenously or exogenously or both.

*P. microspora* is characterized by spherical, ellipsoid or irregular pycnidia, 150 to 340 $\mu$ in height by 180 to 400 $\mu$ in width, with a papilla 60 to 80 $\mu$ in height by 80 to 110 $\mu$ in width, and conidia measuring 5·5 to 6 by 2·5 to 3 $\mu$, tapering at both ends. The conidia are formed on distinct conidiophores from the inner cell layer of the pycnidial wall, the rest of which is, as in the other fungi described above, mainly plectenchymatous.

Notes are given on the microscopic structure of *Phomopsis abietina* [*R.A.M.*, x, p. 278] and *Sclerophoma pityophila* [cf. ibid., ix, p. 281] on pine (*Pinus sylvestris*) needles, and it is stated that in the latter the conidia are developed endogenously. Other fungi characterized by this or other atypical modes of conidial formation are *S. taxodii* Roum. on *Taxodium* (endogenous), *S. strobi* on *P. strobus* (endogenous and also formed by budding from the protoplasts of the cells after the cell wall has partly dissolved), *S. magnusiana* (*P. pitya* Sacc.) in which the process resembles the last, *Blastophoma thuemeniana* n. g., n. sp. (*Sphaeropsis pitya* v. Thümen) on larch branches (conidia formed by budding from isolated cells set free into the cavity of the pycnidium), *B.* (?) *douglasii* n. sp. (*Phoma douglasii* Oudemans) on cones of *Pseudotsuga taxifolia*, *Stictophoma acicola* n. g., n. sp. (*Sphaeronema acicola* Lév.) on pine (*P. sylvestris*) needles (conidia arising endogenously from files of cells in the interior of the pycnidium), *Schizophoma* (?) *pini* n. g. (*Sphaeronema pityophilum* Corda) on pine needles (conidia endogenous in rows or groups of cells), *Tylophoma sorbi* n. g., n. sp. (*Dothiora sorbi*) on *Sorbus aucuparia* (endogenous), *Chondroplea populea* n. g., n. sp. (*Dothichiza populea*) on *Populus nigra* [ibid., xi, p. 338] (differing from the type species of the genus *Dothichiza* in having conidia in rows projecting into the pycnidial cavity and apparently developed endogenously in a wide conidiophore arising from the cells of the innermost layer), and *Corethrostroma laricis* n. g., n. sp. (*P. pityella*) on *Larix leptolepis* (with conidia formed in long crowded rows from the longitudinal division of successive layers of elongated cells lining the pycnidial cavity).

All these fungi and several other allied forms are critically examined and the reasons for their reclassification discussed at length. *Dothiorella populea* and *Cytosporella populi* are regarded as synonyms of *Chondroplea populea*.

SHEAR (C. L.). **Life histories of Tryblidiella species.**—*Mycologia*, xxv, 4, pp. 274–285, 5 figs., 1933.

Pure cultures from single ascospores of *Tryblidiella leprieuri* on dead tea branches supplied by A. C. Tunstall from India give rise to macropycnidia resembling those of *Diplodia natalensis* [cf. *R.A.M.*, x, p. 345] though without the longitudinal striae characteristic of the pycnospores of the latter. Similar cultures of *T. rufula* from *Rhus* in Florida yield micropycnidia with hyaline, subglobose spores, and *Diplodia*-like macropycnidia containing broadly striate pycnospores agreeing with those of *D.* [*Botryodiplodia*] *theobromae* in everything but size, while a species closely

resembling the foregoing from black cherry (*Prunus serotina*) produced macro- and micropycnidia of the same type but distinct from the preceding and in the macrospore form scarcely distinguishable from *D. mori.* Cultures of single ascospores of a *T. rufula*-like form from *Melia* in Alabama give rise to macro- and micropycnidia agreeing with those on *P. serotina*, while those of *T. hysterina* from *Ilex vomitoria* in North Carolina and Alabama produce micropycnidia and macropycnidia resembling those of *D. alni.*

The *Diplodia*-like forms thus obtained show a general similarity to those arising from ascospore cultures of *Physalospora*, thereby indicating the difficulty of separating genera of the Ascomycetes by means of their imperfect stages.

GHIMPU (V.). **Afecţiunile patologice şi inamicii Tutunului din România în 1932.** [Pathological troubles and pests of Tobacco in Rumania during 1932.]—Reprinted from *Bul. Cultivărei şi Fermentărei Tutunului*, Bucarest, xxi, 4, 9 pp., 1932. [French summary. Received September, 1933.]

This is a brief annotated list of the more important parasitic diseases and insects which were observed on tobacco in Rumania during 1932. Besides the four virus diseases previously recorded by the author [*R.A.M.*, xii, p. 580], recent observations have shown the occurrence in the country also of tobacco crinkle as known in America. Kroepoek [leaf curl: ibid., xii, p. 474], and Wisconsin leaf spot (*Bacterium melleum*) [ibid., x, p. 77] are stated to have been found recently on the grounds of the Experiment Station for the Cultivation and Fermentation of Tobacco near Bucarest, and the latter proved to be widespread in most of the Rumanian provinces. Fungal diseases are stated to have caused but little damage to the crop in the year under review.

MOORE (E[NID] S.). **Important to Tobacco growers. The crinkly dwarf menace of Tobacco.**—*Farming in South Africa*, viii, 88, p. 276, 1 fig., 1933. [Afrikaans translation.]

This is a popular note on the symptoms, etiology, and control of crinkly dwarf [leaf curl] of tobacco [see preceding abstract]. Practically unknown in Africa a few years ago, this disease is stated to constitute a serious menace to the crop in East Africa, Rhodesia, and the Transvaal. In the last-named it is not uncommon to see half the plants in a field more or less severely affected, while in some cases the entire crop is rendered worthless by leaf curl, which has even been observed in the seed-beds. Emphasis is laid on the necessity of cleaning up old tobacco lands during the winter in order to deprive the insect vectors (whiteflies) [Aleyrodidae] of infected material on which to feed. By this means the perpetuation of the disease may be largely prevented.

GRAINGER (J.). **The movement of Tobacco mosaic virus in its host.**—*Ann. of Appl. Biol.*, xx, 2, pp. 236–257, 1 fig., 4 graphs, 1933.

The experiments described in detail in this paper were carried

out from 1928 to 1930, chiefly in a greenhouse at a temperature of about 75° F. in Leeds, and partly in a greenhouse at 90° at Madison, Wisconsin, for the purpose of determining the movement and distribution of the tobacco mosaic virus chiefly in the Connecticut Havanna No. 132 variety of tobacco. Uniform batches of five plants were inoculated by needle scratches either at the tip of a leaf, the area of inoculation being sharply delimited by a scratch of the needle at right angles to the midrib, or in a determined region of the stem, from which the subtended large leaves were removed. The tests for the spread of the virus down the leaves were made by severing the inoculated leaves at pre-determined distances below the limit of inoculation after the lapse of a certain time, the distance being greater the longer the period between inoculation and cut, the subsequent development of symptoms in the plants indicating whether the virus had spread into the parts proximal to the cut or not. The study of the spread of the virus up the leaf or stem involved the inoculation of other batches of plants with the juice obtained from a series of transverse strips 1 cm. wide, aseptically cut off at appropriate distances from the inoculation point. The general results of the tests indicated that the virus spreads in the plant at first slowly, but later on more rapidly, and the graphs show a logarithmic relation between the distance travelled and the time taken. The fact that in a typical case, while the inoculated controls showed the first symptoms of mosaic after eight days, the plants whose leaves were cut at a distance of 5 cm. from the inoculation limit after five or seven days displayed the first symptoms 12 days after inoculation, is considered to suggest that the cutting of the leaves removes all but a very small amount of virus, which has then again to begin the process of multiplication and spreading. There was some evidence that the rate of spread of the virus is increased by a rise in temperature.

Experiments to determine the rate of increase in concentration of the virus in the tissues of the host near the point of inoculation indicated that it may be represented by a sigmoid curve of the kind typical of the growth of living organisms and of the rate of accumulation of the catalyst in an autocatalytic reaction. It was also shown that in plants inoculated at the base of the stem the virus travels first to the growing point and the young leaves, where it multiplies and spreads progressively to the older leaves in the inverse order of their formation. When the growing point was removed immediately after inoculation, the appearance of the virus in the young leaves was delayed by about three days. Another set of tests indicated that the virus is capable of moving upwards and downwards across a portion of the stem killed by steaming [cf. ibid., x, p. 66; xii, p. 598], and similarly up and down the leaf lamina across a barrier of steamed tissue. The view that the spread of the virus can take place in the parenchyma is supported by the results of several experiments and the fact that spread was obtained in detached tobacco stems and leaves, the latter of which were kept with their petioles immersed in moist sand after being inoculated at the tip, but the results of tests to determine the ultimate distribution of the virus in mature tobacco

plants which had been inoculated in the seedling stage, showed a surprisingly high concentration of the virus in the xylem.

It was determined by dilution tests that the virus is present in the light green areas of a tobacco leaf at a concentration ten times greater than in the dark green areas.

Naturally produced guttation water from tomato plants infected with the tobacco mosaic does not carry the virus, but guttation water obtained by the application of high pressures to the cut petiole ends was infective from the very start and gave 100 per cent. infection when inoculated into healthy tobacco plants, the suggestion being that the pressure was sufficient to rupture the leaf cells and leach out the virus.

ROQUE (A.). **Bacterial wilt of Tobacco in Puerto Rico and its intertransmission to other Solanaceous hosts.**—*Journ. Dept. Agric. Puerto Rico*, xvii, 2, pp. 145–156, 3 pl., 1933.

The author describes an outbreak in 1931 of bacterial wilt [*Bacterium solanacearum*] in a field of two of the Porto Rican standard varieties of tobacco (Ceniza and Utuado), this being apparently the first case reported on tobacco in Porto Rico, where the disease is prevalent on several other solanaceous crops [*R.A.M.*, xi, p. 29]. Cultural studies and pathogenicity tests of the tobacco organism conclusively established its identity with *Bact. solanacearum* as described by E. F. Smith, and showed that it is readily transmissible from diseased tobacco plants to other solanaceous plants, and from these back to tobacco. Under Porto Rico conditions *Bact. solanacearum* seldom, if ever, attacks tobacco through the aerial parts, infection usually taking place through the underground organs, since in the numerous wilted plants examined the advance of infection could always be traced from the roots upwards. Aerial infections of peppers [*Capsicum annuum*], however, gave positive results.

The fact that the outbreak occurred in a field that had been previously under sugar-cane for many years is considered to indicate that crop rotation is not a reliable measure for the control of the disease, and this is further supported by the fact that the sowing of four varieties of tomatoes in a field which had not borne any solanaceous crop for at least 15 years proved a complete failure from bacterial wilt. Control through the use of resistant varieties appears to be much more promising, since the tobacco varieties tested have shown a wide range of varying susceptibility, most of the local varieties being highly resistant. The Red Bliss Triumph potato is also very resistant. It is only among tomatoes that no resistant variety has so far been found.

WOLF (F. T.). **The pathology of Tobacco black shank.**—*Phytopath.*, xxiii, 7, pp. 605–612, 1 fig., 1933.

The writer's studies at Duke University, Durham, North Carolina, have shown that the rapid wilting and collapse of tobacco plants attacked by *Phytophthora* [*parasitica*] *nicotianae* [*R.A.M.*, xii, p. 471] are due to a toxin, which may be extracted from black shank lesions and is also present in potato broth and Richards's culture solution used for the growth of the fungus. The toxin is

thermostable within a range of 34° to 212° F., non-volatile, and probably partakes of the nature of a protein, being precipitated by crystals of magnesium sulphate added to the filtrate from macerated diseased tissues in distilled water. The black shank fungus produces acids (other than oxalic) during the decomposition of the tissues and in culture media, but evidence was obtained that these substances are not responsible for the wilting of the plants. It also produces enzymes (amylase, zymase, maltase, and invertase) enabling it to utilize the middle lamella, secondary membranes, starch, sucrose, dextrose, and maltose in the host.

HOPKINS (J. C. F.). **Mycological notes. Seasonal notes on Tobacco diseases. 6. An unusual type of frog eye spotting.** —*Rhodesia Agric. Journ.*, xxx, 6, pp. 472–474, 1 pl., 1933.

A brief account is given of a tobacco leaf spot which was observed in a district of Rhodesia in 1933, and which, while exhibiting symptoms almost typical of the brown spot caused by *Alternaria longipes* [*R.A.M.*, xi, p. 207 and above, p. 748], was found to be caused by the frog eye spot fungus (*Cercospora nicotianae*) [ibid., xii, p. 476]. The abnormal aspect of the lesions is ascribed to a prolonged cold and wet period at the beginning of the year, followed by a severe drought later in the season. It was noticed that these spots were most prevalent on the chlorotic lower leaves both during the cold and wet period and during the drought. The fungus isolated from these spots produced spores and conidiophores somewhat differing in their dimensions from the usual type.

WARDLAW (C. W.) & MCGUIRE (L. P.). **Tomato storage. Further observations on the storage of tropically grown Tomatoes.** —*Trop. Agriculture*, x, 6, pp. 161–163, 1933.

The primary object of the work briefly reported in this paper was to establish the effect of different manurial treatment during growth on the keeping qualities of tomato fruits in cold storage. While in early season tests no positive results could be obtained, owing to exceptionally unfavourable weather conditions, which promoted infection of the green fruit by fungi and led to the development of fungal rots during storage, the results of a series of tests carried out later on, when conditions had become drier, showed that tomato fruits grown in the tropics, if they escape infection with fungi, are possessed of good keeping quality in cold storage (17 days at 45·5° F.). During the course of these trials it was observed that out of a total of 254 fungal infections that were investigated, 205 were caused by *Phoma destructiva* [*R.A.M.*, xii, p. 121], and 30 by various species of *Fusarium*.

DODGE (B. O.). **The Dutch Elm-disease in a neighboring State.** —*Journ. New York Bot. Gard.*, xxxiv, 404, pp. 170–171, 1933.

In the *New York Herald-Tribune* of 8th July, 1933, a special dispatch appeared concerning the presence of the Dutch elm disease [*Ceratostomella ulmi*] at Maplewood, New Jersey, where six trees (one of which died within a fortnight from the detection of the symptoms) were proved to have been attacked by the fungus. In this connexion attention is drawn to the survey in progress by

R. P. White and R. K. Beattie for the purpose of locating and destroying infected trees before widespread damage occurs [*R.A.M.*, xii, p. 733]. Millions of bark beetles (*Scolytus multistriatus*) have been found in one dead elm at Maplewood and are suspected of being concerned in the transmission of the disease. The same insect has also been infecting elms at the New York Botanical Garden and in Westchester County; fairly good control of it may be obtained by early and thorough applications of lead arsenate (3 to 4 lb. per 100 galls. water).

**Les pourritures du bois de Chêne sur pied.** [The rots of the wood of standing Oak.] (*Bull. 13, Comm. d'études des ennemis des arbres, des bois abattus et des bois mis en œuvre.*)—*Ann. de l'Ecole Nat. des Eaux et Forêts et de la Stat. de Recherches et Expér. Forest.*, iv, 2, pp. 365–380, 400–401, 406–407, 3 pl., 1932. [English and German summaries.]

An account is given in semi-popular terms of a number of rots which attack standing oak trees in France. Of these, white root rot (*Phellinus* [*Polyporus*] *dryadeus*) [*R.A.M.*, xi, p. 680] though fairly common is comparatively unimportant, as affected trees long retain their vigour and the disease never spreads to a height of more than 2 m. above the ground. Brown cubical rot (*P. sulphureus*) [ibid., vii, p. 205] is widespread and more serious than the last as it may cause the entire trunk to become hollow. There is no diagnostic external symptom, but in very old infections a cavity full of pulverulent débris may sometimes be seen at the base of the tree. In yellow trunk rot (*Phellinus* [*Fomes*] *robustus*) [ibid., xi, p. 812] infection always occurs some distance above the ground and remains limited to a short length and to only a part of the circumference. It affects the sapwood chiefly though spreading to the adjacent parts of the heartwood. The bark over the affected sapwood is killed and the trunk, ceasing to increase in diameter at the spot, becomes flattened on one side, the flattening later appearing as a depression bordered by protuberances marking the limits of the still living part of the trunk. A section at this level shows a thin crescent of rotted wood, often round approximately one-half the circumference but never extending to the centre. The affected wood is soft and yellowish and framed by a narrow reddish-brown band. Infection progresses very slowly and the loss sustained through the disease is slight.

In pocket rot the heartwood turns dark brown, irregular white spots appear, and oval cavities develop but remain separated by firm, brown wood. The condition is caused by various species of *Stereum*, chiefly *S. frustulosum* [ibid., v, p. 267]; *Hymenochaete rubiginosa* (*S. rubiginosum*) causes a similar rot, but with smaller pockets. There are no outward signs by which infection by these fungi can be readily detected. The wood rapidly becomes useless. The disease is rather uncommon in France and apparently limited to certain forests. In all these types of rot, infection begins at a place where owing to wound injury the heartwood is exposed.

A rot known in the French timber trade as 'grisette' is characterized by brown spots interspersed with yellowish or whitish stripes or patches. The disease is due to attack by species of

*Stereum*, chiefly *S. hirsutum* [ibid., x, p. 572; xii, pp. 44, 664], though *S. spadiceum* [ibid., xii, p. 734] is stated recently to have been shown to be also concerned in this type of injury. These fungi become established on dead or broken branches or lopping wounds, and under certain conditions the mycelium passes into the trunk, where it attacks both sapwood and heartwood, spreading in concentric zones in which dark brown, oily spots ('flammes de grisette') appear, elongated in the direction of the axis. These spots spread perpendicularly and tangentially, and the wood turns yellowish or whitish, so that a longitudinal section shows yellow or brown bands separated by white ones. Considerable masses of wood may become discoloured, infection spreading rapidly downwards and slowly upwards from the point of attack. The fungi fructify during winter on the dead branches or the bark of the trunk near by. The coriaceous sporophores, usually grouped or confluent, dry up in summer to a few centimetres in diameter. In *S. hirsutum* the surface of the sporophore is pale yellow and the edges are greyish-yellow; *S. spadiceum* shows a dark grey inner surface and brownish-grey edges.

The grisette disease is serious, as the affected wood is useless. It is also fairly common, infection occurring as branches die or break off in the normal course of events. The trunk may be affected for a distance of 2 or 3 m. below the branch, while a few centimetres above it the wood is still healthy. In most cases the top parts of the trunk suffer a varying degree of depreciation of the timber, but the butt remains unaffected. On standing oak an indication of infection is the presence of circular cushions open at the centre ('gouttières' or 'abreuvoirs') at the insertion of the dead branches. Holes made by woodpeckers under certain nodes indicate a rot of the sapwood which may be associated with the disease.

'Grisette' always results only from the breaking or cutting off of branches, and its spread can therefore be restricted by reducing such types of injury as much as possible.

The paper terminates with directions for controlling the rots by improved sylvicultural methods designed to prevent the trees from developing wounds which leave the wood bare.

**La maladie des Platanes.** [The Plane tree disease.]—(*Bull. 15, Comm. d'études des ennemis des arbres, des bois abattus et des bois mis en œuvre.*)—*Ann. de l'École Nat. des Eaux et Forêts et de la Stat. de Recherches et Expér. Forest.*, iv, 2, pp. 393–398, 403, 409, 1932. [English and German summaries.]

An account is given in semi-popular terms of the symptoms, causal organism, mode of infection, and control of the leaf spot and twig blight of plane trees caused by *Gnomonia veneta* [*R.A.M.*, xii, p. 735]. The disease occurs all over France, especially when the weather during spring is cool and wet, but is more prevalent in the south-west than in the drier Mediterranean region. It is stated that contrary to the general belief, the variety of plane tree cultivated in France is not *Platanus orientalis* (which comes from the eastern parts of the Mediterranean basin and is grown, very exceptionally, in the south of France only), but *P. acerifolia*,

a hybrid of the former and the North American species *P. occidentalis*. The last-named is almost non-existent in France.

RAINIO (A. J.). **Pseudomonas tumefaciens Sm. & Towns. auf Salix caprea.** [*Pseudomonas tumefaciens* Sm. & Towns. on *Salix caprea*.]—*Ann. Bot. Soc. Zool.-Bot. Fenn. Vanamo*, ii, 3, pp. 3–18, 5 figs., 1932. [Finnish summary.]

A description is given of the formation of brown to jet-black galls, 0·5 to 5 cm. in diameter, on the older branches of two willows (*Salix caprea*) near Helsingfors and Tampere, Finland. The galls were composed of leaf and catkin buds and began to develop in the female catkins in May by the transformation of the floral organs into leaves, the subtending leaves of the flower alone remaining normal. The nectaries were converted into small, branched, loose leaflets, covered with thick, long hairs, the stigma was similarly altered, and the lobes were about the same length as the subtending leaves. The catkin axis was abnormally swollen. The leaf-bud galls were mainly terminal and had three or four terminal leaves of normal size but thickened at the base, the other leaves being lobed and the outer ones covered with hairs. By the end of September all the galls had assumed a brown tinge and a woody consistency, those of the catkins being elongated and those of the leaf-buds round. The bases of the leaf lobes had shrivelled into brown scales and the tips were faded.

Galls of this type do not seem to have been hitherto recorded in Finland, and they are apparently uncommon in other parts of Europe.

The larvae of a beetle (probably *Dorytomus taeniatus*) were traced in some 70 per cent. of the catkin galls examined in 1925 but not in any of those formed from the leaf-buds, so that the insects cannot, in the writer's opinion, be held responsible for the development of the neoplasm, more especially as they also occurred in catkins bearing no galls, and on *S. cinerea* from which the latter were altogether absent. Subsequent investigations confirmed this view.

On staining with methylene blue the surface tissues of the galls were found to contain Gram-negative bacteria, measuring 1·8 to 2 by 1 $\mu$, and with flagella at one extremity. Inoculation experiments with the aqueous extract of ground galls on young *S. caprea* and *Pelargonium* stems gave positive results, the artificially induced galls on the former measuring 1·5 cm. and on the latter 8 to 14 mm. in diameter. An attempt to obtain the causal organism in pure culture was unsuccessful, but in morphological and physiological characters it agrees with *Pseudomonas* [*Bacterium*] *tumefaciens*, which has, moreover, been reported to occur naturally on willows in South Africa [*R.A.M.*, i, p. 17] and Denmark (*Tidsskr. for Planteavl*, xxvii, p. 399, 1920).

A study of the temperature at Helsingfors from 1918 to 1931, the period during which the affected trees were under observation, indicates that gall formation is to some extent dependent on the mean temperature in April. Should this fall below 0° C. no new galls are produced even if normal temperatures prevail in May.

On the other hand, when the mean April temperature exceeds 2° gall formation is profuse.

COLE (J. R.). **Vein spot of the Pecan caused by Leptothyrium nervisedum, n. sp.**—*Journ. Agric. Res.*, xlvi, 12, pp. 1079–1088, 7 figs., 1933.

An account is given of the author's investigation of a foliage disease termed vein spot of pecan (*Hicoria* [*Carya*] *pecan*) found in Louisiana, Mississippi, Arkansas, and Texas, which, though unreported, had been collected in Texas as far back as 1920. The chief symptom, due to vein and petiole infection in the spring, is the development of small oval to circular spots on the leaflets and the formation of large dead areas when the midrib or petiole is attacked, leading to severe defoliation. The spots appear first on the ventral, and four or five days later on the dorsal side of the leaves; at first they are yellowish, then brown, and finally dark brown or black with yellowish margins. Macroscopically the disease is strikingly similar to pecan scab (*Cladosporium effusum*) [*R.A.M.*, xi, p. 213], with which it is believed it may have been confused in the past.

The causal fungus, the pathogenicity of which was experimentally established, is considered to be new and is described (with a Latin diagnosis) as *Leptothyrium nervisedum*. The pycnidia are depressed pulvinate, single or in groups, intra- or subepidermal (occasionally in the spongy parenchyma), of irregular shape, and 35 to 95 $\mu$ in diameter. The conidiophores are simple, septate, straight or slightly curved, and 14 to 18 by 2 to 4 $\mu$. The conidia are irregular, oblong or ovate, sometimes curved, hyaline, continuous (but developing a septum at germination), and measure 8 to 13 by 2 to 3 $\mu$; they germinate by germ-tubes from either or both ends. At 15° C. the growth in culture was poor and it ceased at 36°, the optimum being 26°. The optimum hydrogen-ion concentration for growth was $P_H$ 5·9 (range 4 to 8·6). The fungus is believed to live through the winter in the conidial stage.

There was evidence of differences in varietal susceptibility to the disease, especially in Louisiana, where the Van Deman is the most susceptible variety, with Frotscher next. While no experiments for the control of vein spot were made, it was observed to be fairly successfully checked by spraying the trees three times with 3–4–50 Bordeaux mixture, alternating with four applications of 20 parts monohydrated copper sulphate in 80 parts lime, in experiments for the control of pecan scab.

GUYOT (R.). **De la maladie du rond: de l'influence des foyers ou des foyers d'incendie dans sa propagation.** [On the ring disease and on the influence of fires or conflagrations on its spread.]—*Rev. Gén. des Sciences*, xliv, 8, pp. 239–247, 6 figs., 1933.

A summary is given of some important French papers on the so-called 'ring' disease of conifers associated with *Rhizina inflata* [*R. undulata*: *R.A.M.*, xii, p. 550], *Ungulina annosa* [*Fomes annosus*], and *Armillaria mellea*, supplemented by the writer's personal observations on the two last-named in the Gironde and

Landes departments [ibid., ix, p. 279; x, p. 354]. In a recent lawsuit damages were claimed by the owner of a pine stand adjacent to a wood in which the felling operations were followed by the lighting of fires for mechanical and domestic purposes. This led to such a development of *F. annosus* and *A. mellea* as to necessitate the digging of an isolation trench to prevent their spread. Both fungi were found in the roots below the sites of the fires. In collaboration with Hias, the writer has obtained encouraging results in the control of *A. mellea* on pines by exposing the roots and painting them with an iodine solution (0·5 per cent.), while experiments are also in progress with a method of injecting the iodine.

ROOT (G. A.). **Blister rust activities in California in 1932.**—*Thirteenth Ann. Rept. Dept. of Agric. California for the period ending December 31, 1932 (Monthly Bull. Dept. of Agric. California*, xxi, 12), p. 570, 1932. [Received August, 1933.]

At the close of 1932, the ninth year of active pine blister rust [*Cronartium ribicola*] work was completed in California, and during the period under review a very important new project was started in the form of a sugar pine [*Pinus lambertiana*] inventory of the entire State, a joint undertaking with the United States Forest Service. The survey will show the order in which protective measures in different areas should be executed and the estimated cost of the work. During 1932 an initial eradication of wild currant and gooseberry bushes from 800 acres took place in the Stanislaus National Forest, as well as a re-eradication of 3,000 acres first worked in 1928 [*R.A.M.*, xi, p. 143]. So far no trace of the rust has been detected by vigilant inspections in the north of California and parts of the Sierra Nevada, but the southernmost location of infection is apparently in south-western Oregon, less than 50 miles from the Californian boundary.

LINDGREN (R. M.). **Field observations of needle rusts of Spruce in Minnesota.**—*Phytopath.*, xxiii, 7, pp. 613–616, 1933.

This is an extended account of the writer's observations on the needle rusts of spruce (*Picea mariana, P. pungens, P. glauca* and its var. *albertiana*, and *P. excelsa*) caused by *Melampsoropsis cassandrae, M. abietina*, and *M. ledicola* [*R.A.M.*, vi, p. 450] in Minnesota, a note on which has already been published [ibid., xii, p. 67].

**Statutory rules and orders, 1933, No. 558. Destructive Insect and Pest, England. The Importation of Plants Order of 1933. Dated June 7, 1933.**—8 pp., 1933.

The Importation of Plants Order of 1933, effective as from 15th July, 1933, and superseding all previous Orders under the Destructive Insects and Pests Acts, 1877 to 1927 [*R.A.M.*, xi, p. 543], prohibits the landing in England or Wales of all living plants or parts thereof (except seeds) for planting, unless accompanied by a duly authenticated certificate guaranteeing the absence from the consignments of any insect, fungus, or pest destructive to agricultural and horticultural crops. All potatoes must have a further

certificate vouching for the freedom of the place of cultivation and of a surrounding radius of 2 km. from wart disease (*Synchytrium endobioticum*), while the importation of potatoes (tubers, leaves, or stalks) from the United States, Canada, and France is entirely prohibited. All plants (and between 15th March and 14th October each year, raw vegetables and cider apples) from France must have a certificate that Colorado beetle (*Leptinotarsa decemlineata*) has not been known to exist within 200 km. of the place where they were grown. The Order places no restrictions on the landing or transhipment in England or Wales of any produce grown in Scotland, Ireland, the Isle of Man, or the Channel Islands. An authorized inspector may enter any premises and take samples of consignments of plants, potatoes, raw apples, or raw vegetables landed or suspected of having been landed in England or Wales, even if accompanied by the requisite certificates. In the event of such samples being found affected by any injurious insect or fungus pest, the importer may be required to take certain specified steps for disinfection or treatment or alternatively to destroy or re-export the consignment in part or entire. The provisions of this Order do not preclude the issue of licences by the Minister of Agriculture or a qualified inspector for the importation into England or Wales of plants, potatoes, raw apples, or raw vegetables.

Similar regulations have been introduced in Scotland.

**Statutory Rules and Orders, 1933, No. 557. Destructive Insect and Pest, England. The Destructive Insects and Pests Order of 1933. Dated June 7, 1933.**—3 pp., 1933.

This order, which came into operation on 15th July, 1933, prohibits the keeping, sale, or release of any insect (which is defined to include bacteria and other vegetable or animal organisms causing plant disease) of a non-indigenous species except under licence of the Minister of Agriculture. Provision is made for the inspection of suspected premises, and for the destruction of infectious material if required.

A similar order is made with regard to Scotland.

**Amtliche Pflanzenschutzbestimmungen.** [Official plant protection regulations.]—*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, v, 1, pp. 28, 38–39, 42, 51–54, 1933.

GERMANY (RHINE PROVINCE). From 18th November, 1932, to 1st October, 1942, all Canadian poplars [*Populus canadensis*] in the Düsseldorf district suspected of canker (*Nectria coccinea* var. *sanguinella*) [*R.A.M.*, x, p. 698] or dying-off (*Dothichiza populea*) [see above, p. 790] must be officially inspected by the competent authorities and any diseased trees destroyed.

ESTHONIA. An Order of 18th November, 1932, requires the eradication of buckthorn (*Rhamnus cathartica*) and barberry (*Berberis vulgaris* and its var. *atropurpurea*) with a view to combating the cereal rusts caused by *Puccinia coronifera* [*P. lolii*] and *P. graminis*, respectively. The work must be carried out within three years both on public and private lands [cf. ibid., xii, p. 672].

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